BELL TELEPHONE MAGAZINE

VOL. XX FEBRUARY, 1941 NO. 1

THE BELL SYSTEM AND NATIONAL DEFENSE

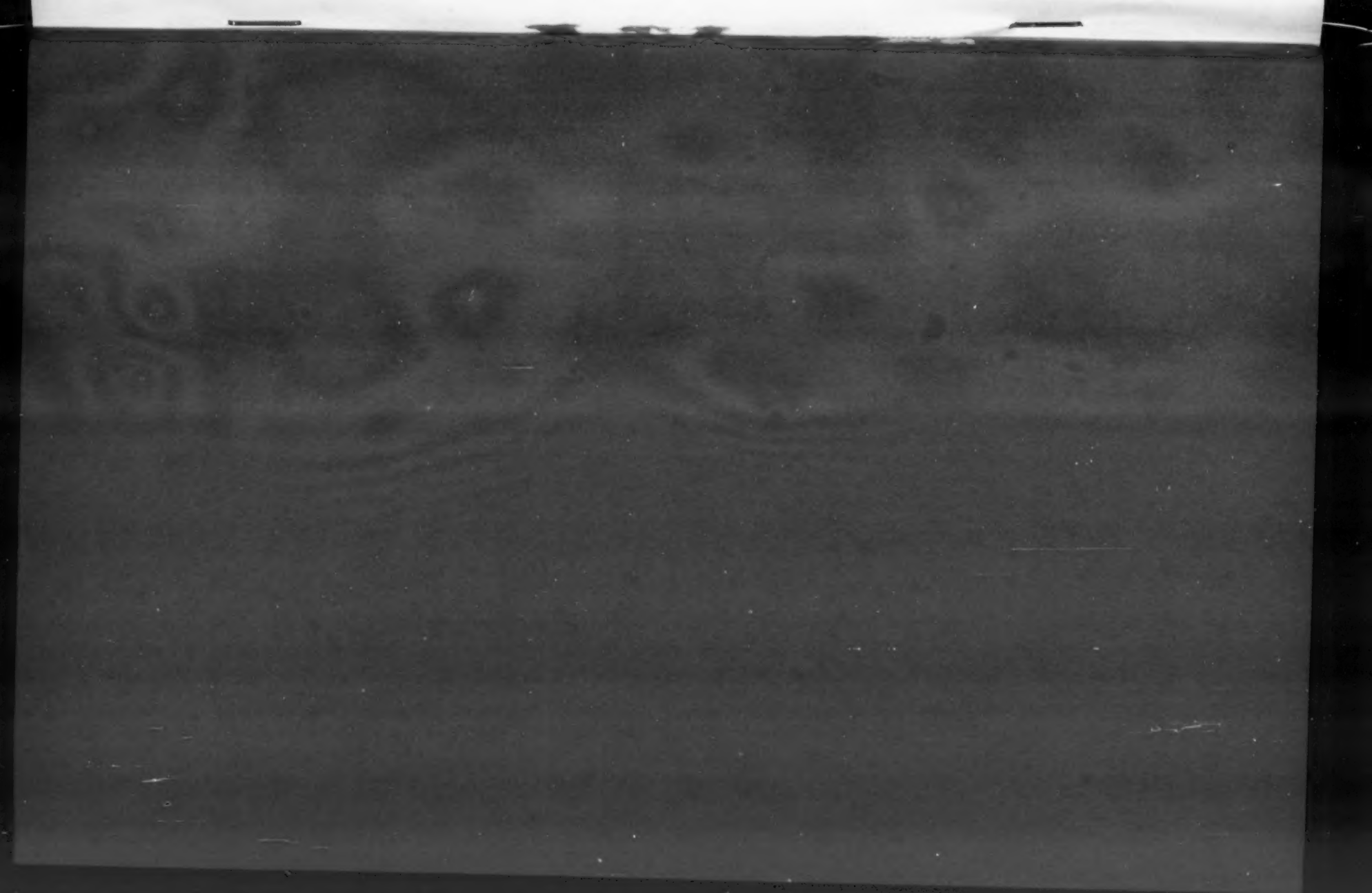
PIONEERING IN RADIO TELEPHONY

MAKING TELEPHONE DIRECTORIES BETTER

HOW OUR POPULATION IS CHANGING

THE CONQUEST OF A CONTINENT

AMERICAN TELEPHONE & TELEGRAPH CO. • NEW YORK



BELL TELEPHONE MAGAZINE

Continuing the BELL TELEPHONE QUARTERLY

A Medium of Suggestion and a Record of Progress

VOL. XX FEBRUARY, 1941 NO. 1

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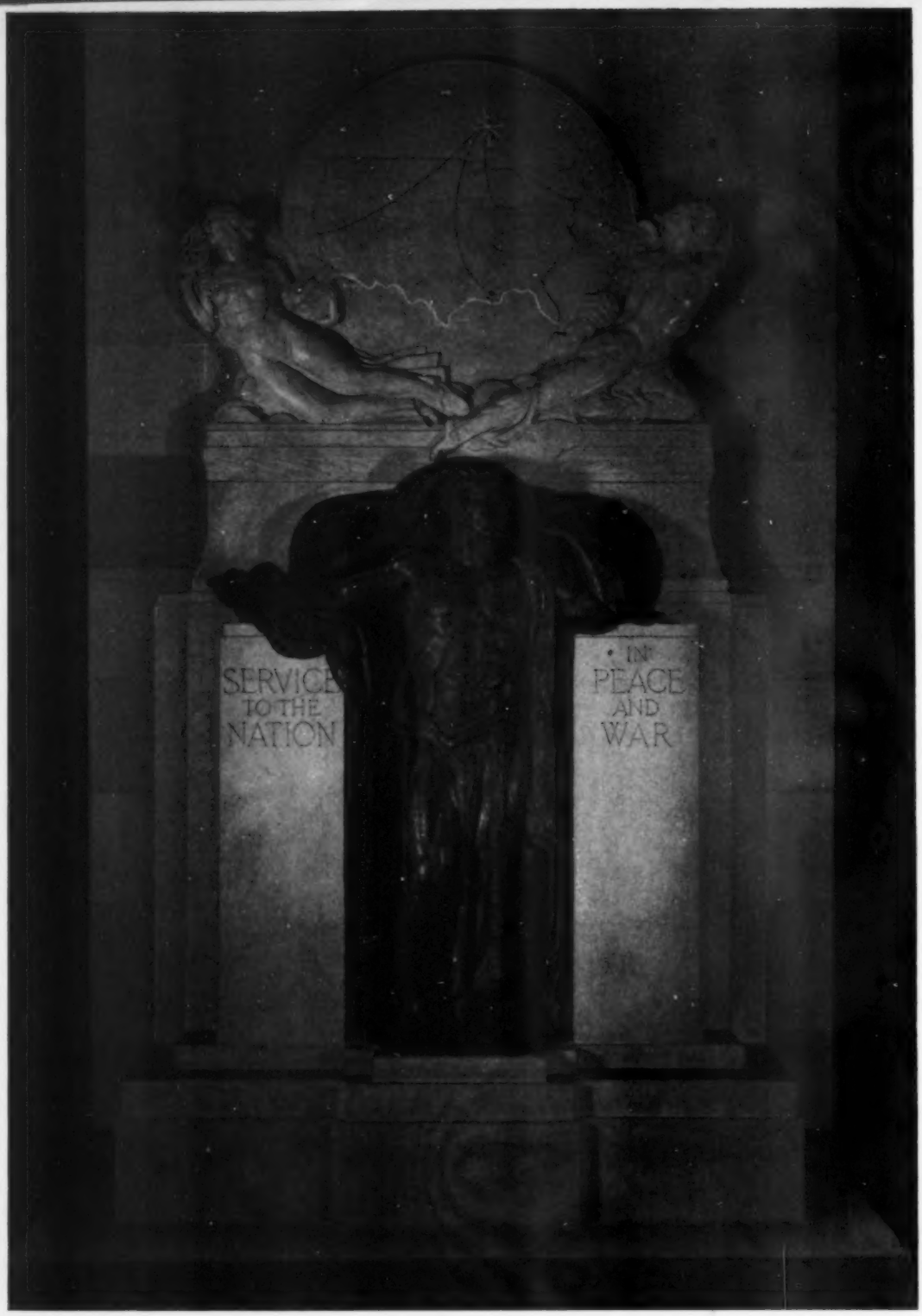


SERVICE TO THE NATION IN PEACE AND WAR

Bronze and marble group in the lobby of the American Telephone and Telegraph Company building, New York

THE BELL SYSTEM AND NATIONAL DEFENSE

The System's Nation-wide Organization and Capacities Enable It to Meet the Vast Needs of the Armed Forces and of Industry for the Services and Equipment So Vital to the Defense Program

By JUDSON S. BRADLEY

On the wall of an inner office in the Bell System's headquarters building in New York hangs a large map of the United States. It is studded with a mosaic of more than 400 vari-colored pins. They cluster along the seaboards, are thick in the south and the industrial mid-west, scatter seemingly without pattern in other parts of the country. Were one to journey to all the places designated by those bright pin-heads, he would see much of the nation's defense activity: columns of marching men, and men spread thin in skirmish line; rows of tents, and barracks springing up over vast areas; the long runways of airports, and bulldozers knocking down hills to make more; pile drivers hammering away at new docks, and sleek gray vessels taking shape on the ways; huge factories in various stages of construction. For each pin in that map marks a point where the Bell System operating companies are providing communication facilities for a military or naval establishment—Army training camp, naval base, Coast Guard station, aviation field, ordnance or airplane plant.

Inspiring would be such a comprehensive view of the country's defense program. And it would gain in interest for System people because at each point visited there would be—either actually or figuratively—telephone men at work.

The Bell System's capacity for this and other defense work was the theme of a radio broadcast by President Gifford, and of an advertisement in magazines of nation-wide circulation, a few months ago. Current advertisements include the statement, "The Bell System is doing its part in the country's program of national defense." Such pledges are, necessarily, generalizations. To the question of what the System's part is, and how it is doing it, there are, in detail, many answers. Of these that pin-studded map is a partial summary.

A city of 40,000 or 50,000 is a sizable community. Such a place represents many years of growth. It has a history, traditions, an individuality. Among the many services which have grown with it through the years is that of the telephone. Yet today "cities" of that size are being built,

THE CAPTAIN GOES UP

The Post Signal Officer of a huge Army camp examines the fine points of a splice in an Army cable just completed by the Bell System men on the ground

constructed from the ground up, in the course of a few months, at a number of locations in the United States: Army camps for the young Americans who are to receive a year of military training, for members of the National Guard who have already been called out by Presidential order. And for those "cities" telephone service must be provided—likewise, in many cases, from the ground up. Smaller camps —and there are many—present the same problem in scale. Government-owned munitions and aviation plants must have service too. So must the Federal housing projects which are planned or going up near many of the cantonments and factories.

As President Gifford pointed out, the Bell System is able to provide that service, and the necessary equipment, through systematic planning, ample stocks and manufacturing capacity, skilled and loyal men and women; and through and with full coöperation between all branches of the System and all branches of the Government concerned in the defense effort in all its many aspects.

Service to the Many Camps

THE nation's defense program centers in Washington, of course. There the American Telephone and Telegraph Company has for some years maintained an office, in order that it may be in a position to coöperate quickly and completely with the various government departments. Word is received there as soon as a decision has been reached to construct a new Army camp or expand an existing post, to set up an Army or Navy air base, to build a munitions or airplane plant. First definite news may include not much more than the location, the size of the establishment, an estimate of the communication requirements, and the expected dates for start of construction and for occupancy. But that is enough to put the wheels in motion.

All available necessary information is flashed to the Associated Bell Company in whose territory the project is to take shape, to the Western Electric Company, the System's manufacturing and supply arm, and to A. T. & T. headquarters in New York. Certain preliminary deductions can be made at once. A camp for a given number of troops will require a private branch switchboard to serve a certain number of lines; about so many feet of distribution cable; an estimated number of public telephones and booths for the convenience of the men. The telephone company's engineering, plant and

commercial officials, Western Electric's local distributing house manager, confer, plan. Western can look ahead, schedule tentatively.

Service *on* the post is only part of the story, however. What about service *to* the post? Big new military establishments are being built in thinly populated territory, often miles from the nearest town. And that may be a small town, receiving telephone service through a switchboard ample for the needs of its few residents but not originally engineered to handle the number of calls which will flow to and from a camp where the daily life and training of thousands of men are being administered. In such case, the central office switchboard will have to be enlarged, perhaps two or three fold. An addition to the building may be necessary. In more than one instance, an entire new central office has been created near the camp as the most satisfactory solution of the problem.

Do a few open wires run past the site of the proposed camp? Those poles should be carrying cable too by the time the constructing Quartermaster and the contractors have opened their field offices and are ready for service, providing pairs later for

FULL CO-OPERATION

Signal Corps and Bell System men working on an Army cable close to the camp telephone headquarters in the background, where Western Electric has installed a multiple P.B.X.

READY ON TIME

Three months, to the day, after ground was broken, this new central office was ready to give service to a big camp located between two small towns. The 30-position switchboard is the largest of its type in the Bell System, and space has been provided for another 30 positions if they should be needed

the Army's P.B.X. too. What about toll circuits? The facilities will in all probability have to be enlarged to handle a sizable increase in long distance calls.

All these things are reviewed by the operating company and Western Electric. They discuss, plan, on the basis of experience and present knowledge. A. T. & T. staff men are always available for consultation.

MEANWHILE, the picture takes on constantly clearer definition. Supplementary information in more and more detail becomes available: in Washington, from the War Department or the Navy Department, as the case may be; from the headquarters of the corps area or the naval district. Plans for the camp become definite, the scheduling of telephone equipment and construction can proceed with assurance. The Government signs the order for service—but that is nearer the last step than the first, for much has gone before.

A big camp does not go up literally over night; it takes time to build. So does telephone equipment. Those two facts are complementary. Thanks to the opportunity for advance planning in the field, preliminary scheduling of manufacture, and ample shop facilities, "shipped same day ordered" is a frequent notation against Western Electric's record of the disposition of some piece of apparatus for Government service. Central office switchboard sections must be added, larger quarters provided, cables run, more operators provided and trained—all on schedules carefully worked out to meet the needs for service.

Not all of the Government's defense projects are as large as some of the huge new Army cantonments. Nor do all of them require the manufacture and installation of large amounts of plant and equipment, since some call

simply for additions to existing facilities. But communication is vital to them all, and the defense program does call for new service or additions to existing service at Army and Navy headquarters in Washington, at Corps Area and District headquarters, at regular Army posts, Army air bases, anti-aircraft firing centers, National Guard concentration camps, replacement centers for draftees, Quartermaster supply depots, National Guard aviation units, Coast Artillery units, Coast Guard stations, Marine Corps bases, present naval bases, naval air bases, naval training stations, ordnance and airplane plants, hospitals, and housing projects.

Some of these establishments are located in the territories of independent telephone companies. They too furnish the Government with nation-wide long distance service through connection with the Bell System network.

In normal times, the Army buys, builds, maintains and operates its own telephone systems and its own fire-alarm systems at the larger permanent posts on Government reservations. It always builds, maintains, and operates its harbor defense fire control and target range systems. An agreement of long standing with the Bell System covers the furnishing of and payment for lines to the telephone company central offices; similar agreements are in effect with the independent telephone companies concerned.

Said Major John G. Grable, Signal Corps, U. S. A., in an address before the U. S. Independent Telephone Association:

CENTRAL-OFFICE ENLARGEMENT

An addition was made to the building and the switchboard was more than doubled in this central office, in anticipation of the telephone needs of a near-by Army cantonment

ARMY SWITCHBOARDS

Communication on a post is provided through a Private Branch Exchange switchboard, either manual or dial, as needed, which also connects with a telephone company central office. Above: A Bell System P.B.X. instructor trains an Army operator. Left: A Western Electric installer discusses circuit layouts with members of the Signal Corps

"The Chief Signal Officer wishes to express his appreciation of the excellent coöperation that has been rendered during the present emergency by commercial telephone companies and manufacturers of telephone material and equipment. Without a single exception, the demands made by the Army for service and for rush shipments of material and equipment—and I would like to say that many of those requests have been of such a nature that they would appear impossible in other circumstances—have been met right on time and every effort made to assure that the service and equipment are satisfactory."

Research and Manufacture

ONLY the most general mention may be made of certain special undertakings which both the Bell Telephone Laboratories and the Western Electric Company are carrying out directly with and for the Army and Navy.

Since the Laboratories is one of the major development organizations in the communications field, it is natural that its unique knowledge and facili-

ties should be directed toward defense measures where they will be of greatest value. The adaptation of telephone circuits to serve new and special needs, and the application of scientific principles to the solution of new problems, are matters currently receiving major attention. It is also reassuring to know that substitutes have been developed for certain materials which have become difficult to obtain in recent years, and that research along these lines is actively continuing.

Similarly, the Western Electric specializes in the methods and manufacture of communication equipment. In Western's Specialty Products Division, wheels hum and lights burn late to turn out communication equipment of many kinds ordered by and to be delivered directly to the Army and Navy. The full implications of that statement may best be understood from the brief explanation that the value of these orders, at the beginning of the present year, is about $31,000,000.

Aircraft Warning Service

FOR a number of years, the Bell System and independent telephone companies have coöperated with the Army, during various military maneuvers, in technical exercises looking

HELPING TRAIN SIGNAL CORPS INSTRUCTORS

The Signal Corps men shown here are going through a complete Bell System Plant School course, including the various phases of construction and maintenance (right) as well as class-room instruction (below). They will, in turn, become instructors in their battalion

CAMOUFLAGED BATTALION COMMAND TELEPHONE POST

During maneuvers and field exercises, Signal Corps men simulate war-time conditions. The equipment shown here is of Western Electric manufacture

toward the establishment and operation of an Aircraft Warning Service.*

Briefly, a corps of observers is organized from the civilian population to man observation points located throughout large sections of the country. Each observation post is provided with telephone facilities which permit reports of hostile airplanes seen or heard by the observers to be flashed directly to Air Defense Command operation centers, where officers direct defense measures against the invading bombers. Observers' reports are handled with special priority and by special operating methods over the regular communications network of the telephone companies.

A large-scale test of the effectiveness of such an aircraft warning service took place in the northeastern part of the country early this year. The Bell System's experience, gained in earlier similar activities, was placed at the service of the Army, and telephone company officials in the territory covered worked closely with officers of the Air Defense Command in charge of the exercises.

Service to Expanding Industry

THE Army and Navy have long been known as our first line of de-

* "A War Game Test of Telephone Service," QUARTERLY, January, 1939; "Another War Game Test of Bell System Services," QUARTERLY, July, 1940.

fense. But against the kind of war being waged today, is Industry any less so? Each day's newspaper headlines, the newscasters' radio summaries, the grist of reports and statements from Washington, have made the answer familiar to everyone; it is *no*. To Industry the nation looks for the things which make defense possible, from ships and shoes to—perhaps—sealing wax; there is no need to recount here the multiplicity of products, from uniforms to airplanes, which the country's defense program requires for fulfillment.

Equally well known is the manner in which Industry is responding to the pressing need: speeding up production, doubling and tripling ultimate capacity by additions to existing plants and the construction of new buildings.

To this aspect of defense, communication is as vital as it is to the Army and Navy directly. Administration of a vastly expanding business calls more than ever for telephonic intercommunication within a plant, for adequate facilities for local and long distance services. A P.B.X. switchboard which has long been quite sufficient must now be replaced, almost over night, by one two or three times its size. New central-office connections must be provided. Cables must be run from the firm's main office to serve telephones in new buildings, and wires must be run in those. It is not unusual in the experience of more than one Bell System company to find

NEW SWITCHBOARD FOR THE NAVY

A yeoman stands by at this P.B.X. recently installed to serve a Naval District headquarters

THE PELORUS WATCH STANDS BY

Bearings on objects, or on other vessels, are communicated to the Navigator by telephone

it expedient to assign several plant men regularly to one expanding industrial establishment, simply to take care of the day-to-day requirements for changes and extensions of telephone service.

All this is occurring not in occasional isolated instances, nor even here and there, but in hundreds of plants working on Government orders all over the country. And here, again, the Bell System generally finds it possible to meet Industry's requirements for service and equipment adequately and promptly.

And, obviously, there must be, and is, provision for an increasing use of telephone service which reflects the heightened tempo of activity throughout the nation.

The Country's Telephone Network

IN aerial wire lines and in cable the Bell System and the independent connecting companies have nearly one hundred million miles of wire. These wire facilities are used to interconnect the nearly twenty-two million telephones which are served by some nineteen thousand central offices throughout the United States. On a map of the country the lines are suggestive of a loosely and irregularly woven fabric overlaying the entire nation.

For the past twenty years or more, construction of toll and long distance lines has been planned not only to furnish the circuits necessary to meet an increasing use of the service but also to provide alternative routes between the country's largest cities. The purpose, of course, has been to insure maintenance of communications in almost any contingency. As a result, today the Bell System has access, telephonically, to every major city over several different routes. In this way, even though an accident should completely disrupt service over one route, a detour will usually continue the flow of calls with little or no delay to traffic.

Traffic control bureaus for the longer haul routes are located in New York, Cleveland, and Chicago. They keep a general watch over the ebb and flow of traffic throughout the country, and manipulate the supply of circuits to meet the constantly changing pattern of traffic.

Due to anticipated defense requirements and to the general stimulation of business which accompanies the defense program, the Long Lines Department of the American Telephone and Telegraph Company increased its 1940 construction program to $21,000,000, which was $9,000,000 above the amount spent in 1939. The Associated Companies also increased their

building programs during 1940 above those of the previous year by amounts depending upon their several requirements.

Chief among the major projects of this construction program were a new underground cable laid last year between Baltimore and Washington at a cost of about $1,000,000; and the start of construction of a new cable between Omaha and Denver. This cable will be pushed through to California, and will connect the long distance cable network serving the East with that which serves the Pacific coast.

Last year communications facilities along the eastern seaboard routes were supplemented by important additions on various links all the way from Boston to Florida. Here, "carrier" systems provided many new channels along the Atlantic coast, as did they also along the fourth transcontinental line from Oklahoma City to Los Angeles.

AN important extension scheduled for this year is that of twin underground cables linking Richmond and Norfolk, Va., to serve Norfolk, Newport News and the vicinity, where there are concentrated extensive ship building, naval, and army activities. Others planned for the next few years include twin underground cables about 700 miles in length, from Atlanta, Georgia, to Miami, Florida; a new cable between Los Angeles and San Diego; and twin cables between Seattle and Portland. A second cable to be placed along each of several existing routes will substantially increase long distance

THE FIRE ROOM WATCH AT SEA

On a modern battleship, the fire room watch maintains telephonic communication with other departments

facilities into the southwest, where Army activities on a large scale, particularly aviation, will be centered. This program envisions by the end of 1943, exclusive of the transcontinental route mentioned above, cable construction on more than 4,000 miles of principal toll routes which are now served by open wire.

The construction of these new cables will be accompanied by the extension of the network of broad band telephone transmission systems. "Carrier" systems are being superposed not only on new cable facilities but on existing cable routes. Circuits so provided are of high quality and are particularly well suited for use in establishing alternative and protection circuit routes. Each of the multi-cable routes, as proposed, can accommodate as many as 50 or more carrier systems, each of which will provide twelve telephone circuits.

Various measures, mentioned below, have been taken to protect the physical telephone plant. But above and beyond such steps as are possible to guard against injury of any kind, the greatest protection to the nation's telephone service, now so vital to the defense program, is the criss-crossing web of wire and cable which stretches from border to border and from ocean to ocean. Its very size makes it, in its entirety, unassailable, while the provision of so many alternative speechways precludes that any important place, or section of the country, should be cut off for long from the rest of the nation.

Protecting the Service

PROTECTION of every phase of the service against serious interruption, either accidental or intentional, is, of course, a highly important aspect of the Bell System's responsibility for nation-wide communications. It is not the intention to defeat the purpose of precautions which have been taken by describing them in detail or by connecting those mentioned with any definite locality. On the other hand, a summary of the more important steps taken belongs in any comprehensive account of the System's part in the national defense program.

The protective measures fall into three general groups: those dealing with personnel, those safeguarding the outside plant, and those having to do with protecting the buildings and the equipment inside them.

Before proceeding with other parts of the program, it was highly important that telephone employees—particularly those in the Plant Departments and others whose work includes actual contact with vital telephone equipment—should be acquainted with the purposes of the precautionary measures to be taken. Letters from company officers impressed upon such employees the need for protective measures, and further emphasis was given by group meetings and discussions held throughout the organizations.

STUDENT PILOT

In this Link Trainer, the naval aviation student gets his instructions by telephone while he is "in the air"

MOBILE COMMUNICATION POST

Pictured here is the interior of an Army truck, where the teletypewriter has been installed for field use

Surveys of citizenship have been made which confirm the fact that extremely few employees are not citizens, either by birth or by naturalization. Detailed information about employees—up to and including department heads—who work directly with international telephone circuits, both wire and radio, has been furnished the Federal Communications Commission at the latter's request.

Records have been prepared showing the men who are subject to call for military duty. Plans have been developed for replacing men so affected. Data relating to prospective temporary employees are being maintained with an eye to insuring an adequate service force in case of emergency.

IN addition to the alternative toll routes previously mentioned, alternative toll entrance routes are being established, and other safeguards have been employed at points of importance where operating centers might be isolated through the temporary loss of toll entrance cables. Various plans are in effect for emergency routing of toll service, while other plans exist for the provision of toll service in case of serious damage to a toll building or an intermediate repeater station. Another safety precaution bearing on the outside plant is the application of continuous gas pressure to more hundreds of miles of the toll cable system.

The provision of emergency power in case of possible failure of the normal supply has received attention. A considerable number of large fixed engine-alternator sets and smaller portable sets are being added to supplement the many already available to fill the breach in the event of the temporary loss of outside power.

Other potential emergencies have been anticipated—so far as it is possible for experienced telephone men to foresee and to provide against accidents or other causes of interruption to the service. Plans already exist, for example, for the restoration of telephone service to various government buildings, hospitals, police headquarters, railroad stations and important manufacturing plants, in case the facilities serving these buildings should be damaged or destroyed.

One of the most interesting items in the emergency program is the expanding use of portable radio telephone sets, to span temporarily line breaks which would take a considerable length of time to repair and which might be so widespread as to leave no alternative routes in service.

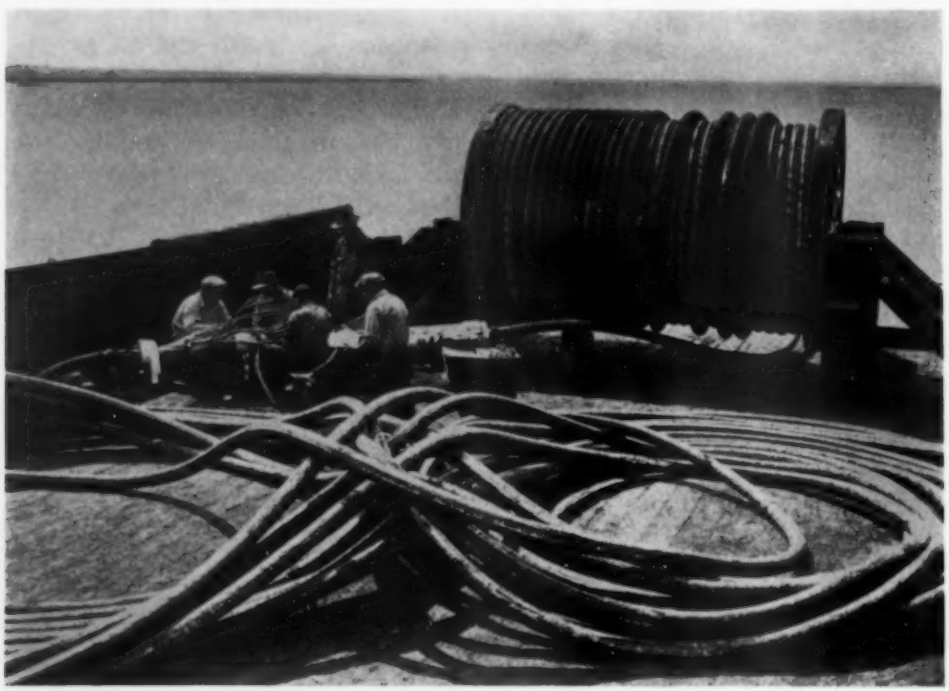
Several emergency uses in the past year or two have proved the worth of these portable radio sets in times of disaster. While each pair—sending and receiving—provides only one circuit, there are times when even one circuit is priceless. It is natural, therefore, that the Bell System companies are adding to their present supply of such equipment.

TELEPHONE buildings — local exchanges, toll centers, test stations, repeater stations, radio telephone stations, factories and warehouses—each presents its own individual problem of protection. Particular attention has naturally been paid to guarding all means of entering buildings housing important telephone equipment, as well as their immediate surroundings. Every important telephone office has been given individual consideration and has been provided with precautionary measures, both inside and out, designed to meet its individual situation.

In response to a questionnaire sponsored by the National Association of Railroad and Utility Commissioners, the several units of the Bell System have furnished to the respective public utility commissions in the states in which they operate a large amount of information about existing and projected plant facilities, measures taken for the maintenance and restoration of service in emergency, and similar matters relating to national defense.

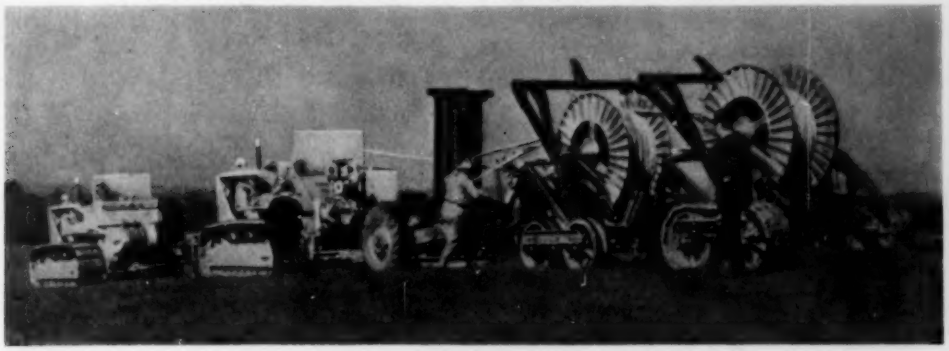
Men in Service

A CONSIDERABLE number of Bell System men who are members of the National Guard, Army and Navy Reserve, etc., are now on active duty. Operation of the Selective Service Act has taken relatively few as yet, but will no doubt call more in successive drafts. The Adjutant General has di-



SUBMARINE TELEPHONE CABLE

Laid under an eastern river recently, this speechway is an important addition to communication facilities along the Atlantic coast



PLOWING CABLES INTO THE GROUND

Pulled by two powerful tractors, the plow in the middle of this rig can cut a narrow slot in the ground from 30 to 48 inches deep, into which telephone cables from the two reels at the rear are fed as the train moves along. Under favorable conditions, several miles of cable can be buried in a day

rected that employees of the Engineering and Plant Departments who are chosen be assigned to the Signal Corps.

For men called into the service under the terms of Public Resolution No. 96 (summoning the National Guard, Reserves, etc.) or the Selective Service and Training Act of 1940, the Bell System provides, in brief, that employees will be granted a year's leave of absence, will receive credit for System service during that period, will have the protection of the Benefit Plan in the event of death, and will be offered re-employment in accordance with the provisions of the Selective Service Act. In addition, each of the Companies makes an adjustment payment to employees, for periods ranging from one or two weeks up to three months, of the difference between their Company pay and government pay.

Several System officials already occupy important posts in the defense program. Dr. Frank B. Jewett, Vice President of the A. T. and T. Company and Chairman of the Board of the Bell Laboratories, is serving as a member of the National Defense Research Committee, heading the group concerned with transportation and communication, in addition to his responsibilities as President of the National Academy of Sciences. William H. Harrison, A. T. & T. Vice President and Chief Engineer, who has been on leave of absence for some months as Director of the construction division of the production department of the National Defense Advisory Commission, has recently been appointed a chief executive of the Production Division of the Office of Production Management, in charge of ships, construction, and supplies. Still others from the A. T. and T. Company, Western Electric, the Associated Bell Companies—experts in engineering, statistics, personnel work—have been loaned to those branches of the defense effort where their experience and capabilities will have particular value.

At the request of Mr. James Law-

rence Fly, Chairman of the Defense Communications Board created by Executive Order last September to determine, coördinate, and prepare plans for the national defense, President Walter S. Gifford of the A. T. and T. Company is serving on the Board's Industry Advisory Committee on behalf of the Bell System companies, and has been elected its chairman. The System has also named representatives and alternates on five of the eleven committees designated by the Board to assist in carrying out its functions by providing for continuing studies and for contact with other government agencies and with the civil communication industry. These committees are the Telephone, the Telegraph, the Radio Communication, the Domestic Broadcasting, and the Aviation Communications Committees.

FLASH MESSAGE FORM

Call your telephone central and say: "ARMY FLASH _____" (Give your phone number)
Central will connect you with an Army Information Center.
When you hear: "ARMY, GO AHEAD PLEASE", you say: "FLASH"
and continue message you have checked on form below, in the order indicated:

1	2	3	4	5	6	7	8
NUMBER OF AIRPLANES	TYPE OF AIRPLANES	WERE AIRPLANES SEEN OR HEARD?	ALTITUDE OF AIRPLANES	YOUR OBSERVATION POST CODE NAME	DIRECTION OF AIRPLANES FROM O. P.	DISTANCE OF AIRPLANES FROM O. P.	AIRPLANES HEADED TOWARD
(Number) FEW MANY	SINGLE-MOTOR BIMOTOR MULTI-MOTOR	SEEN HEARD	VERY LOW LOW HIGH VERY HIGH		NW N NE W E SW S SE If Airplanes were directly over O. P. Circle Columns 6 and 7 by reporting: "OVERHEAD"	(Miles)	NW N NE W E SW S SE Omit if it will cause delay in report.

RPB—1-2-41—50M

CONFERENCE ON AIRCRAFT WARNING SERVICE

Seated at the end of the table are President Walter S. Gifford of the A. T. and T. Company, and Major General James E. Chaney, head of the Air Defense Command during the recent test of the Aircraft Warning Service. Others in the group are Air Corps and Signal Corps officers, and officials of the A. T. & T. Co. and the New York Telephone Company. Below is a Flash Message form used by civilian observers in telephoning their reports

CONSTRUCTION SPECIALISTS

Center figure in this group, observing progress at an Army camp, is William H. Harrison, A. T. & T. Vice President and Chief Engineer, who after seven months as head of the construction division of the NDAC has been placed in charge of ships, construction, and supplies in the Production Division of the Office of Production Management in Washington

THE nation's defense program is, in size and scope, stupendous beyond description. What part the Bell System, with its Associated Companies from coast to coast, its headquarters group, its research and manufacturing organizations, is playing in this program has been but sketched in outline here.

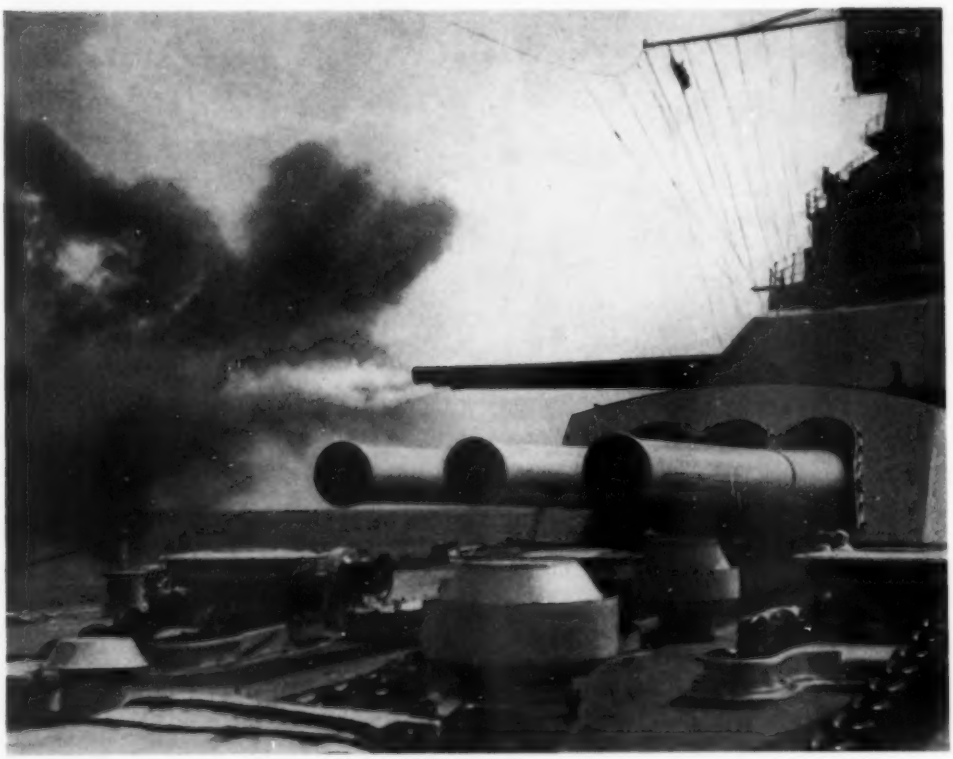
Enough has been said, however, to indicate that the Bell System has long realized—and soberly faced—its share of responsibility for national defense.

The outbreak of war on the continent of Europe in the Fall of 1939 had immediate repercussions throughout the System. Every aspect of the business was completely and thoroughly reviewed, with the objective of being adequately prepared for an increase in demand for service which might arise for any cause or from any source. (It is notable that in that fateful September of 1939 an upward surge in toll calls throughout the country of from 25 to 40 per cent—a huge increase, in absolute numbers—was handled smoothly and efficiently.) The steps which have followed, from review to planning, from planning to action, have kept pace so far with the communication needs of the country's defense program. No man can

say surely what these next momentous months will bring; but the Bell System hopes to keep abreast of the service requirements which are still to come—and is implementing those hopes with all the skill and the resources of its nation-wide organization and the sincerity of the 325,000 men and women of which it is composed.

IN 1928 there was placed in the lobby of the American Telephone and Telegraph building in New York the heroic bas-relief which is reproduced as the frontispiece of this issue. Sculptured in bronze and marble, it bears as its sole legend the words "SERVICE TO THE NATION IN PEACE AND WAR." The last dread word referred, of course, to the events of 1917 and 1918. None could dream that again so soon this country would be engaged in a program of national defense. But such a program is here. In it the Bell System has its essential share, and its pledge remains:

SERVICE TO THE NATION. . . .



PIONEERING IN RADIO TELEPHONY

The Part Played by Individuals Co-operatively in the Events Which Ushered In a New Era of Communication Is Revealed in the Records Compiled in the Historical Library

The following article on the historic radio telephone experiments of 1915 is based in the main on the personal recollections of some fifteen of the men who took part in them. Their memoirs were collected several years ago at the suggestion of Dr. Frank B. Jewett, now Chairman of the Board of the Bell Telephone Laboratories, Inc., who himself played a leading role in the events of more than a quarter of a century ago. These intensely interesting documents are on file in the American Telephone Historical Library, New York.

—THE EDITORS

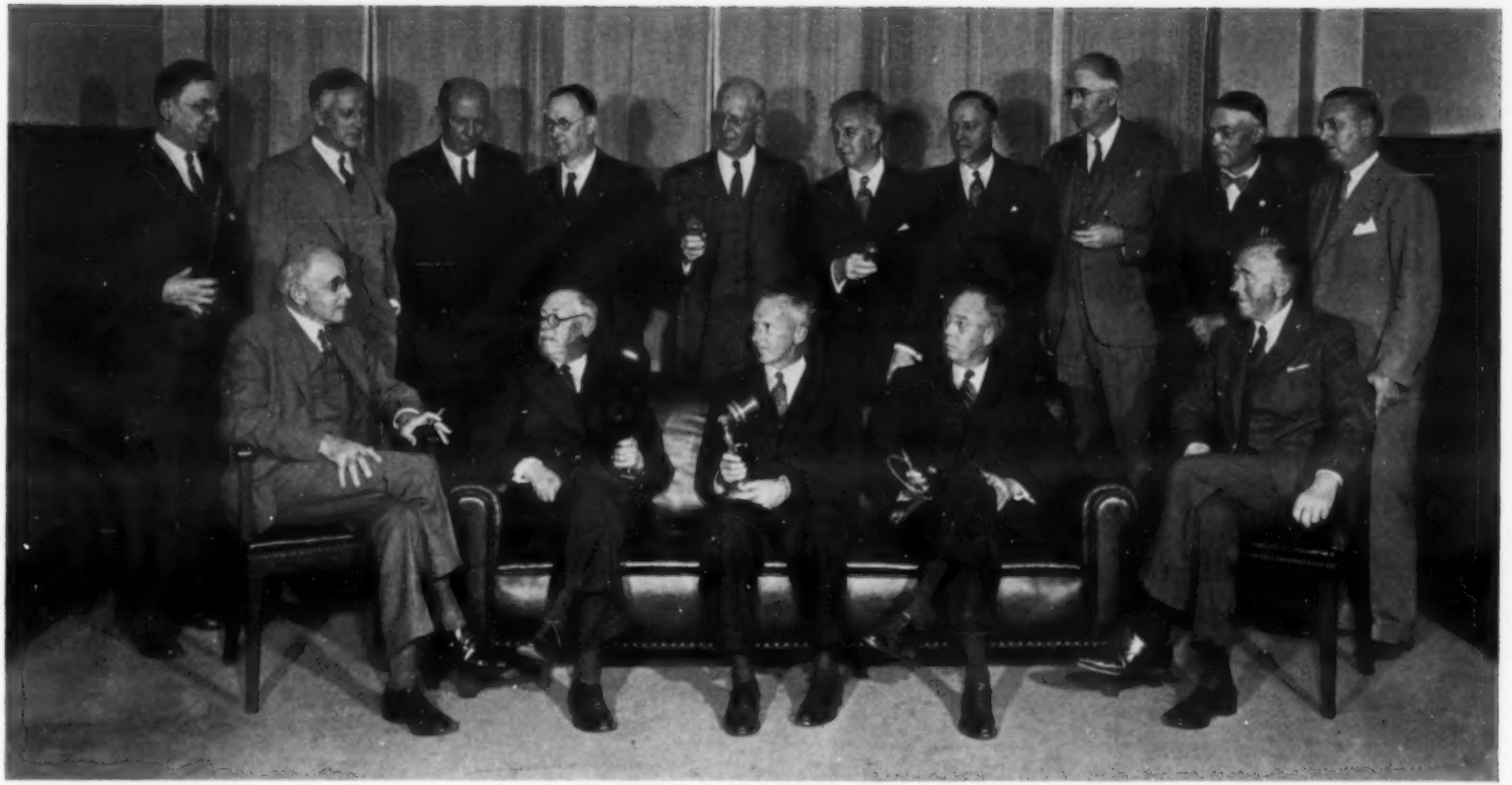
IN one of his poems, Rudyard Kipling uses these arresting lines:

Things never yet created things—
Once on a time there was a man.

Rarely have these words found more striking illustration than in the development of the radio telephone as the world knows it today: a means of communication by the spoken word that is world-wide in its reach; facilities for radio broadcasting which bring millions of listeners within the sound of a speaker's voice. In order to make possible these globe-girdling facilities for the transmission of speech, "things" almost innumerable have had to be created: vacuum tubes in a wide variety of forms; tuning coils and condensers; intricate networks of wires for antennas; even more intricate systems of wires that form the circuits of transmitting and receiving apparatus.

But none of these "things" created itself. Behind each of them—down to the least essential element of this far-flung system of facilities—has been human imagination, human effort. Behind each small detail of this vast Thing that is called Radio Telephony there lies the statement of fact with which so many nursery stories begin, and which Kipling paraphrases: *"Once on a time there was a man."*

Or, more properly speaking, behind each of these details that have been built into the creation of modern radio telephone communication there has stood not one man, but many. For it is impossible to put one's finger on a single contribution to the achieve-



QUARTER-CENTURY ANNIVERSARY MEETING

Reunited on October 21, 1940, the twenty-fifth anniversary of transatlantic radio telephony, were: (Standing) R. A. Heising, W. Wilson, O. E. Buckley, A. M. Curtis, B. W. Kendall, R. H. Wilson, H. Weinhart, R. V. L. Hartley, C. R. Englund and H. W. Everitt; (Seated) F. B. Jewett, H. E. Shreeve, B. B. Webb, L. Espenshied and E. H. Colpitts

ment of this modern miracle, and to say of it, "This thing was done by such an one, alone and unaided." Modern research is not carried on in that way. It accomplishes its results, if another quotation may be permitted,

By the everlastin' teamwork of every bloomin' soul.

Even a quarter of a century ago, Bell System research and experimentation were carried out on this coöperative basis. So far as the achievements of 1915, in which the human voice was made to span the ocean, were concerned, they could have been brought about in no other way than by the coordinated effort of many men, working on many phases of an over-all problem.

A New Problem and a New Art

THIS problem was new. Some experimentation in radio telephony, over relatively short distances, had been carried on by DeForest, Fessenden, and others, but it was not short-haul radio telephony that was now contemplated. Bell System scientists and engineers, under the leadership and direction of John J. Carty, then Chief Engineer of the American Telephone and Telegraph Company, had succeeded, in 1914, in transmitting speech across the continent. Even before this was achieved, Carty had begun to dream of making the human voice span the seas. And transmission over such distances involved new factors that made whatever had been learned by previous experiments practically useless for the project then contemplated.

For satisfactory radio telephone transmission over great distances, a high power current had to be supplied to the antenna of the transmitting station, and this current had to be modulated—that is, varied in pitch and intensity, so as to reproduce the variations of the human voice. Up to this time radio telephone transmission over really long distances had been impracticable because, although there were known ways of establishing high frequency currents in the antenna, the variations in those currents corresponding to voice sounds were too small, and it was these variations which carried the spoken word.

THE system developed by the engineers and research men under Carty's direction was so completely a departure from those previously tried that in reality it constituted a new art. Essentially it consisted in generating a very small current of the radio type —a current so small that it could be completely modulated by a current from a telephone transmitter. The current thus modulated was then amplified until it was strong enough, when flowing in an antenna, to produce the desired effects at a distance.

In order to provide this amplification, one group of Bell System men undertook a series of studies in the electronic nature of the three-electrode vacuum tube. This was the invention of Lee DeForest, and rights to its use had been acquired by the American Telephone and Telegraph Company several years before. Much research and experimental work had already been done in developing the device (originally used by its inventor as a detector of radio signals and called by him the Audion) into a dependable high-vacuum tube which could be

used as an amplifier or repeater of the Transcontinental Telephone Line. This important achievement was in the main due to the efforts of the late H. D. Arnold.

These studies were continued under Arnold's direction after the development of the telephone repeater, and on their basis, new types of tubes were produced, a hundred or more times as powerful as any that had been previously designed or even imagined. Methods were worked out for the use of the vacuum tube as a modulator. To receive these radio telephone signals, new and improved receiving circuits, also utilizing vacuum tubes and the principles and methods of amplification which had been developed in part for transcontinental wire telephony, were devised.

How the Job was Assigned

IN general charge of the entire radio experimental program, and reporting directly to Carty, was Frank B. Jewett, then Assistant Chief Engineer of the Western Electric Company, which at that time maintained what is now the Bell Telephone Laboratories. He was assisted by E. H. Colpitts, Research Director of the same company. In no small measure as a recognition of the outstanding work he had already done on the vacuum tube, Arnold was made senior member of the research group.

Besides initiating many of the steps required in carrying on the program of research and experimentation in this new field, these three key men were responsible for coördinating the efforts of the groups to which specific problems or developments were assigned. These included two laboratory groups reporting to R. V. L. Hartley: one headed by R. H. Heising, working on the development and design of transmitter apparatus; the other, under R. H. Wilson, performing a similar function as to receiving apparatus development. In addition to supervising the work of both of these groups, Hartley was individually responsible for much of what was done on the receiving equipment.

Continuing the basic studies of the electronics of the vacuum tube, initially instituted, as has been seen, for the purpose of repeater development, was H. J. Van der Bijl. The production of high power tubes of the proper quality and in sufficient quantities for the purposes of the experiments was assigned to O. E. Buckley. Concentrating on various phases of this preliminary work were B. W. Kendall, W. Wilson, C. R. Englund and others. When the actual work of radio transmission and reception began, many of these men did duty in the field, at first at Montauk, Wilmington and St. Simon's Island and later at Arlington, Panama, San Francisco, San Diego, or Honolulu, as did others, including John Mills, B. B. Webb, H. W. Everitt, Lloyd Espenschied, H. E. Shreeve and A. M. Curtis.

Nearly All Still in Service

INDICATIVE of the rapidity with which radio telephony has been developed—and of the youth of the men who were responsible for this development in its early stages—is the fact that, with the exceptions of Carty and Arnold, the men who played prominent parts in the experiments of 1915 are still living. A few, like Colpitts and Shreeve, have retired from active

GROUP AT MONTAUK POINT, L. I., ON APRIL 4, 1915

Left to right: Messrs. Christopher, Arnold, Blackwell, Mills, Jewett, Carson, Robert A. Millikan, Espenschied, Carty, Col. Samuel Reber, Thurber, Scribner, and Gherardi

service. Van der Bijl was for some years Director of Research and Chairman of the Power Authority of the Union of South Africa, where he is now Director General of War Supplies. The remaining members of the group are still actively engaged in the research and experimental work of the Bell System.

The youth of these men—and their lack of practical experience with the radio art—is one of the features that first and most forcibly impresses one who reads their accounts of their experiences. Thus Buckley had become an employee of the Bell System in July, 1914, and had been in the laboratories less than a year when he was precipitated headlong into production and tests of the power tubes which were to be used in attempting to transmit the voice through space across the Atlantic and wide stretches of the Pacific. R. A. Heising arrived at the laboratories at about the same time, and his reminiscences assure us that he saw his first three-element vacuum tube on July 27, 1914. Van der Bijl had a similar experience, though about a year earlier.

THOUGH they lacked practical experience with the vacuum tube, these young Bell System scientists had something far more valuable. Many of them had Ph.D. degrees; all of them were trained physicists, mathematicians, or engineers. They knew the formulae for approaching the job of finding out what they had to learn. They could compute, observe, reach conclusions, and apply these conclusions to the problem at hand.

The spirit with which they went about their work recalls that of the nameless hero who is quoted as having said: "I will find a way—or make one!" Each phase of the over-all problem was assigned to one man, or a small group of men, and they went

to work with a will. Arnold found—or made—a way to transform De-Forest's device into a really efficient high-vacuum tube. Others patiently studied its characteristics, learned how to stabilize its performance; found—or made—ways of putting it to different uses.

For they had another quality, in addition to their fundamental training as scientists. If they had the inexperience of youth, they had also compensating characteristics that went with or arose out of their youthfulness. Out of the pages of their reminiscences—which, by the way, are written with a curious degree of modesty, each writer protesting that the part which he played in the success of the project was, after all, only a minor one—there leaps at the reader an inescapable feeling of the enthusiasm, the optimism, and the boundless energy with which these young engineers went about their job. There were, as we shall see, phases of that job that called for high courage, when sleet-covered towers had to be climbed.

THERE were other phases that called for an even higher form of patient endurance—"two-o'clock-in-the-morning courage"—when men stationed alone at distant points had to listen, night after night, for signals or spoken words which, it seemed, the crashes of static would never let through to their ears. There were menial jobs to be done with hammer and saw, pick and shovel, broom and dustpan, which were done with a laugh and a humorous shrug of the shoulders that still is suggested in the light-hearted way in which the writers of these reminiscences have recounted their experiences, a quarter of a century after those days of humdrum tasks which later proved to be historic.

As has been intimated, it would be impossible, even if it were desirable, to evaluate the part which any particular man played in the work that was then being done in laying the foundation for the radio telephony of today. It may be impossible, in the present article, even to mention the names of all of those who took part in this work. It will certainly be impossible to give any detailed and connected account of what happened in the field of radio telephony during that memorable year, a little over a quarter of a century ago. It is not the purpose of this article to do so. Its aim is, rather, to catch glimpses of some of these men at their work, in order that thus the reader may understand the spirit that lay behind the over-all job that then was done.

The Challenge of the Oceans

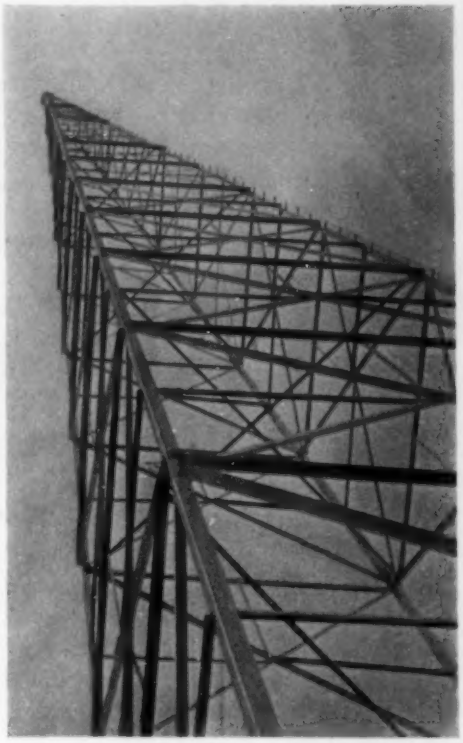
IT would appear that, as early as the end of 1913, Carty had tentatively suggested experimentation in radio telephony as an activity in which the Bell System research staff might well engage. The final order to go ahead seems to have been given about the end of 1914. When it was given, it was accompanied by an injunction to proceed without delay. From Carty down to the most recently employed college graduate on his research staff, they looked upon what they were about to engage in as a great adventure, and one that they approached with a zest that made them impatient of inaction.

And so these young physicists and engineers were instructed to drop

everything else and prepare for what was to be the first convincingly successful demonstration of the transmission of speech by radio telephony. As has been pointed out, the over-all task was subdivided into parts, and a part assigned to one man or a group of men: some to work on the transmitting sets; some to design the best possible "hook-up" for a sensitive receiver; some to make surveys for advantageous locations for transmitting and receiving stations; some to put up the temporary buildings to house these stations, erect towers, string antennas; some to coördinate all these highly specialized efforts.

THE notes of almost all of these men give evidence of long periods characterized by results that were discouraging in the extreme; failures, followed by the trial of something else that worked a little better; dogged and patient cutting and trying until, at last, fairly satisfactory results were achieved.

But alertness—the habit of keeping one's eyes and mind open for any possible suggestion that might prove helpful—played its part as well. One of the men, for example, had been sent to Virginia to make a study of points that might be selected for a receiving station. As his train was pulling into Wilmington, Delaware, his eye caught a glimpse of two tall masts on a roof in the business section. He investigated, found that they were on the Dupont Building, and had been used by a now defunct wireless telegraph station to support its antennas. Upon his recommendation, the location was selected for the receiving station for the Bell System's radio telephone experiments.



MONTAUK POINT TOWER

This is the 165-foot structure which Espenschied had to ascend on April 4, when a blizzard had laid the antenna on the ground

Other shrewd observations by young engineers, equally alert to the relevance of the seemingly insignificant, led to vitally important improvements in apparatus or in methods of its operation. Much of this work went on simultaneously, and had to be coordinated by Carty, Jewett, Colpitts and others who had general supervision of the job. By the last of March, such progress had been made that Easter Sunday, April 4, was set for the first demonstration.

Montauk to Wilmington

RECEIVING apparatus had been set up at the point selected at Wilmington. Meanwhile John Mills and others had erected two 165-foot steel towers at Montauk Point, Long Island, had strung their antennas, and had installed transmitting apparatus in a small wooden structure built for the purpose. A group of executives of the American Telephone and Telegraph Company, with prominent guests, including the physicist Robert A. Millikan and Col. Samuel Reber, of the U. S. Army Signal Corps, made their way to the wind-swept point of Long Island to witness the tests.

BUT Mother Nature was in no mood to yield without a struggle to the conquest of a realm over which she had for ages held undisputed dominion. On the night before the scheduled demonstration, a blizzard, accompanied by severe sleet, blew in from the ocean. As Sunday morning dawned, the tall steel towers were coated with ice—and the transmitting antenna lay on the ground, useless.

John Mills describes with not a little relish his recollection of the scene as Espenschied, a stiff derby hat jammed firmly on his head, climbed the ice-coated steps of one of the towers to replace an end of the antenna, while H. J. Christopher, a New York Telephone Company lineman, performed a similar service on the other tower. The job was not without inconvenience, not to say peril, for 165 feet is a long way up when it has to be traveled foot by foot on steel steps glazed with ice, and with a high wind blowing in from the stormy Atlantic. But, some way, Espenschied and Christopher reached the top, restrung the antenna, and got back to solid ground without mishap.

The demonstration went off, a little delayed, but with encouraging success. Speech transmitted from Montauk was picked up at Wilmington and was carried back over a long distance telephone circuit to those who were listening at its point of origin. It was also received at a monitoring radio station which had been set up at the laboratories, 463 West Street, New York City. The distance of the Montauk-Wilmington transmission was approximately 200 miles—not great, as radio channels are measured in these days, but an epochal achievement twenty-five years ago.

Reaching for New Goals

BUT 200 miles was not enough for people who were dreaming of sending speech by radio telephone across the Atlantic. They reached out for new goals, and their next objective was transmission from Montauk to St. Simon's Island, off the Georgia coast —some 800 miles. Here we catch glimpses of John Mills, who had been sent down to select a site and erect a line of masts to support the receiving antenna. He was joined by Sydney Hogerton, then District Superintendent of the Long Lines Department, with headquarters at Atlanta, and a crew of construction men who were to erect the masts.

Each mast was to be made by lashing two poles together. The poles had been ordered, but did not come. Mills, Hogerton, and their plant gang awaited their arrival, with growing impatience. Without asking instruc-

ST. SIMON'S ISLAND RECEIVER

The improvised masts, and the apparatus shack in the distance, are shown in this picture

tions from New York, Mills further illustrated the formula: "Find a way —or make one!" Buying a number of beams and planks from a local lumberman, these telephone men set six thirty-foot beams in the marsh, so that their ends projected about ten feet from the ground. To the top of each of these, two planks were bolted, one being about twice the length of the other. This staggered arrangement made possible the progressive raising and bolting of new sections of planks and beams, each slightly smaller than the last, so that when the structure was completed, it was tapered. When properly guyed, this improvised line of radio masts, with the antenna which they supported, was quite adequate to the purpose for which it was intended. Incidentally, they prompted no end of speculation on the part of the natives of St. Simon's as to just what they were for. Mills recalls that he was supposed by some of them to be a German agent, but that most people thought he was in the pay of Japan.

A crew from the Southern Bell Telephone and Telegraph Company built a six-pole loop to connect the testing hut with a nearby toll line. On May 21, 1915, speech sent out from Montauk was picked out of the ether at St. Simon's. Two-way conversation was made possible by using a long distance circuit from St. Simon's to Montauk and New York.

MEANWHILE, demonstrations had been given to officers of the United States Navy, including Captain (later Rear Admiral) W. H. G. Bullard. It was the generous coöperation of such open-minded officials as Bullard and Colonel Reber, a personal friend of Carty, that later made it possible to attempt the more pretentious program of transmitting speech across the Atlantic. But in the early stages

of his contact with these Bell System engineers, Bullard was far from being enthusiastic. Writes R. A. Heising, in his reminiscences:

> Captain Bullard told me late that year that he had no faith in our being able to talk across the Atlantic when the subject was first broached to him. He felt it was the idea of people who knew nothing of radio. He didn't expect telephone people, of all people, to be able to do it. It was only the fact that the engineers who approached him had unquestioned reputations in the engineering world that prevented him from throwing them out and dismissing the proposal from his mind. He therefore listened politely to what they had to say, and witnessed the tests without being convinced. They seemed to be so enthusiastic about the project, however, that he finally thought that as it was their own money they wanted to spend, they should be given whatever opportunity there was, and he would look into the matter further.

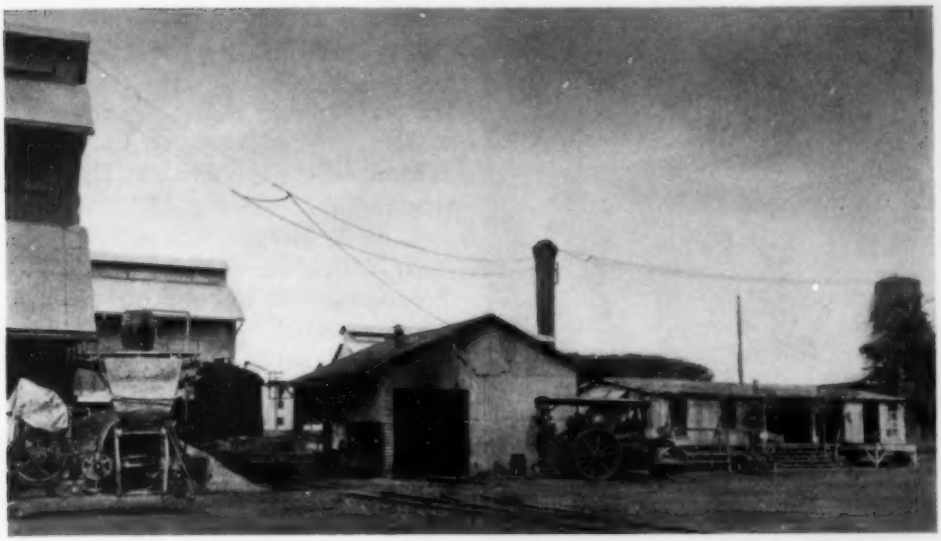
Contagious Enthusiasm

THE enthusiasm of this group of radio telephone pioneers was, as a matter of fact, the driving power that not only convinced outsiders, like Captain Bullard, and later the French military authorities in Paris, but inspired the less sanguine of their own associates to believe that the telephone organization was embarked upon an adventure which would eventually lead to vitally important results. If there ever was, in the history of scientific research, what may be described as self-starting zeal, that was the thing which kept these young engineers at their tasks, despite all too frequent experiences that would have dampened the spirits of less ardent souls.

The demonstrations before the naval officers led to the Bell System's obtaining permission for the use of certain government radio telegraph stations for the more ambitious project which was now to be undertaken. It was realized that enormous expense and delay would be involved if the Bell System were to erect towers of sufficient height for use in attempting to transmit speech across the Atlantic, and other towers at the various points at which it was planned to attempt to receive this speech. It was proposed that the United States Navy give permission to the Bell System engineers to connect transmitting apparatus to the antenna at the great wireless telegraph station at Arlington, Virginia, and that similar permission be granted to connect receiving equipment at naval stations at Darien, Canal Zone; Mare Island, near San Francisco; Point Loma, San Diego; and Honolulu, Hawaii. The good offices of the United States Navy were also sought as a means of persuading the French military authorities to permit receiving apparatus to be installed in the Eiffel Tower, Paris.

Getting Ready for the Tests

THANKS in no small measure to the interest and coöperation of Captain Bullard, all of the desired arrangements were made, and by the end of May, 1915, the necessary apparatus was on its way to these widely scattered points. The mere job of manufacturing, packing, and shipping this equipment was in itself a formidable one. This was particularly true of the vacuum tubes which were to supply the power for the transmitter at Arlington. On this point, Dr. Buck-



ANTENNA AT HONOLULU
This was Espenschied's listening post at Pearl Harbor

ley's brief account of his experiences sheds an interesting light. After describing how he and his associates at times worked on a twenty-four hour basis while producing the tubes (one of them, on one occasion, doing a thirty-six hour stretch) Dr. Buckley writes:

> Not the least exciting incident was the shipment of the tubes to Washington. A special express car had been set aside; I had personally seen to the packing of the tubes and had ordered a heavy truck for the purpose of transporting them safely. Our shipping department fell down on the job and at the last moment came through with a light horse-drawn cart on which we packed our precious tubes and with which I rode, in fear and trembling lest they be smashed, to the ferry and escorted them to the special express car reserved for the shipment and saw them safely aboard. This completed my contribution to the Arlington demonstration.

Twelve to fourteen tubes, connected in parallel, had been used in the transmission to Wilmington and St. Simon's Island. It was recognized that more tubes would be required if speech was to be sent over the vastly greater distances now contemplated. Before Paris and Honolulu were reached, after months of effort, 550 of these tubes had been installed in banks at the Arlington station, filling practically every nook and corner of the little building which the Bell System men had erected at the base of the tower to house their apparatus.

Pioneers in More than Name

FREQUENTLY these tubes would become overloaded and explode with a bang and a crash of broken glass, falling into the air-blowers that were installed below them to keep the tubes from becoming too hot. Now and then an engineer would inadvertently get his knuckles in the way of the

H. E. SHREEVE IN 1915
It was he who heard, in Paris on October 21, the words transmitted from Arlington, Va.

blades of the blower fans, with most unpleasant results. On at least one occasion, one of the men in charge at Arlington received more voltage than any human form could absorb without serious discomfort, not to say danger. They were pioneers in more than name, these young men who blazed the trail for modern radio telephony. They did things—of necessity—"the hard way."

Nor was the task of those who had been sent out to listen for the speech which their associates were to transmit from Arlington a job for what Thomas Paine described as "sunshine patriots." At their distant listening posts they waited, like sentries assigned to patrol a given post, for something to happen that, it must have seemed to them, never would happen. Most of them reached the points to which they had been assigned early in June, 1915. The earliest of them to report the reception of speech from Arlington was R. H. Wilson, who did so from Darien on August 25.

R. V. L. Hartley was at San Francisco, W. Wilson at San Diego, Lloyd Espenschied at Honolulu and H. E. Shreeve and A. M. Curtis at Paris. If circumstances had been different —or, perhaps, if as much had then been known as is known now about the effect of atmospheric disturbances on radio transmission—it is quite likely that this ambitious project might not have been undertaken during the time of year that was, unfortunately, chosen for it. Particularly in the tropics, distant flashes of heat lighting, if not the roll of not-so-distant thunder, were almost daily or nightly occurrences. Crashes of static formed an almost impenetrable wall through which no speech could possibly have made its way. At some of the receiving points, moreover, reception was all but blotted out by the "sparks" of high-powered wireless telegraph stations. The time allotted at all receiving points, with the single exception of Honolulu, was limited to periods when the authorities in charge of the stations were not using facilities for their own communication purposes. This was particularly true as to the use of the Eiffel Tower, for France was engaged in a death struggle with Germany, and every moment of antenna time was precious.

Sentries of Science

THE problem that faced these men at their "listening posts," therefore,

resolved itself into one of sitting for minute after minute, night after night, with receivers at their ears—and fervently praying that, by the grace of Providence, a period of particularly strong transmission from Arlington might coincide with a period favorable for reception at the point where they were stationed, with both static and spark interference miraculously hushed at just the right moment. Weary business, for although acoustic shock was prevented by a volume limiter built into the receiving apparatus, listening to sudden crashes of static in the headset was not a pleasant sensation, to put it mildly! These sentries of science might have recalled the words of Milton: *"They also serve who only stand and wait."*

But atmospheric conditions were getting better; and improvements in the transmitting apparatus, increased power, modifications in the receiving equipment, and skilled and patient attention to details at the Arlington transmitter and at all listening points gradually resulted in success.

Espenschied, at Honolulu, had given another demonstration of making a way when one could not be found. He had received permission to connect his receiving apparatus to the radio telegraph station in downtown Honolulu. On all sides of the naval base ran electric light and power wires, and he surmised—and on experiment proved—that these would seriously interfere with reception. But he found, at the Pearl Harbor Naval Reservation, then under construction some distance from the city proper, conditions that were more favorable. So between a water tank, a power house chimney, and a steel

B. B. WEBB

It was his voice that Shreeve heard in Paris. Note the high-quality microphone, 1915 version, used in transmission from Arlington

building he strung his antenna, installed his apparatus in part of a small shack used by naval engineers as an office, and went to work at his job of listening. Incidentally, he had an opportunity to demonstrate anew his ability at climbing, of which he had made use at Montauk, for he himself had to mount the power house chimney in order to get his aerial in place.

A Job Requiring Diplomacy

THE job assigned to these listeners at their distant outposts was one requiring qualities that would have fitted them for the diplomatic corps. For obvious reasons, the whole project was undertaken with considerable secrecy. It was distinctly ***not*** intended that publicity should be given to the enterprise until it had reached

a satisfactory conclusion. On this point it may perhaps be of interest to record that the good people of Honolulu gave evidence of considerable inquisitiveness as to just what it was that the young visitor from the States was doing in their tropical midst. And it may be of further interest to add that the first information they got on this point was an account published in a Honolulu paper of October 1, based on cables received from the United States, to the effect that words spoken in Arlington had been heard in Hawaii. A later account gave sufficient details to apprise the Hawaiians of the fact that it was their Mystery Man who heard these ocean-spanning words, and that this had been what he had come to Honolulu for, some months earlier.

MEANWHILE, satisfactory reception had been achieved at San Francisco and San Diego, and a demonstration of transcontinental radio telephony had been given on September 29. During this demonstration, Theodore N. Vail, then President of the American Telephone and Telegraph Company, and a group of other telephone officials in New York, had talked to Mr. Carty in San Francisco by radio telephone and had received his replies over the newly-opened transcontinental telephone line. It was, as a matter of fact, a part of a coast-to-coast conversation that Espenchied had picked up in Hawaii.

As far as these widely separated outposts in the Canal Zone, on the Pacific Coast, and in Hawaii were concerned, the enterprise had been an undoubted success. But with Shreeve and Curtis in Paris, things were going badly. The French military authorities, through General Ferrié, had graciously and generously granted the use of their largest antenna for brief periods, when Shreeve had applied to them, through the United States Embassy, early in June. It was now October, and the struggle on the battle front was taking on more and more of the characteristics of a mortal combat. The listening period had to be still further shortened, lest messages of vital military importance, including German transmissions, which were sometimes picked up at the Eiffel Tower, be missed altogether. As days lengthened into weeks and little or nothing came through from Arlington, it was apparent that the time was fast approaching when, courteous though the French were, the two Americans would find that they had worn out their welcome.

Encouragement from Col. Ferrié

SOME of the French officers who had been assigned to coöperate with Shreeve and Curtis had already made it apparent that their patience was becoming exhausted. Shreeve writes:

> I decided that we had better have a heart to heart talk with Ferrié and find out just where we stood. . . . I explained that things were not going very satisfactorily with our experiment and that there was some evidence that we were making nuisances of ourselves. I told him that if this were the case I wanted to be advised of it officially, and that we would then withdraw. General Ferrié listened to me very patiently and said, "What you say is quite correct in some respects. Your experiment has taken longer than we expected. We are a very busy people,

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SUCCESS!

Shreeve's cablegram to Jewett, announcing that he had heard in Paris words transmitted from Arlington

engaged in a terrible war in which our existence as a nation is at stake. However (and at this point General Ferrié left his chair and came over to where I was sitting and put his hand on my shoulder) I say to you, sir, *continue*, for two reasons: first, we have taken the time to check you up and know you are gentlemen and what you represent yourselves to be; and second, you are engaged in a very interesting experiment which I hope will succeed. . . . Permit me to issue to you a sufficient number of passes to insure that you will have no difficulty in reaching your experimental apparatus."

But if this long wait in Paris had its moments of tension, it had also its moments at which Shreeve and Curtis can now look back with not a little amusement. Thus, Shreeve tells of an experience when he and Curtis, strolling in the Montmartre district on an evening when their duties did not require their presence at the Eiffel Tower, were spotted by a group of French nursemaids as strangers, and were hurried by a gendarme before the *Maire*. To both of these officials the Americans exhibited *permis de sejour*, passports, etc., without appar-

GOUVERNEMENT MILITAIRE DE PARIS

COMMANDEMENT DU GÉNIE

DIRECTION
du Matériel du Génie

TÉLÉPH. : { GAXE 20-60 / GAXE 10-25

Paris, le ..... 191..

Le Lieutenant-Colonel FERRIÉ.
Directeur Technique de la Radiotélégraphie Militaire.

à Monsieur .....

PROCES-VERBAL sommaire des expériences de téléphonie sans fil faites entre ARLINGTON et la TOUR EIFFEL.-

La station américaine d'ARLINGTON, ayant été munie de générateurs d'ondes spéciaux, établis par [illegible] et disposés de manière à permettre de faire des émissions de Téléphonie sans Fil, la dite compagnie dûment accréditée auprès du Département de la Guerre par l'Ambassade des ETATS-UNIS à PARIS, a chargé un de ses Ingénieurs (M. [illegible]) d'essayer d'entendre ces émissions téléphoniques au poste radiotélégraphique de la Tour Eiffel, en utilisant des récepteurs également créés par elle.

Tous les essais faits ont été suivis à la Tour Eiffel en tous détails par le soussigné ou par des Officiers de son Service (Capitaine BRENOT et PINCEMIN, Lieutenant de VALBREUZE):

Une première série d'expériences faites en Juin 1915 n'a pas donné de résultats, probablement en raison des perturbations électriques naturelles très intenses en cette saison.

Une deuxième série, en Octobre 1915, a été plus heureuse. Il a été possible de percevoir très distinctement à plusieurs reprises des paroles telles que " One two three etc; good bye etc." Suivant l'intensité des perturbations électriques naturelles ou l'état de l'atmosphère, les paroles étaient entendues plus ou moins distinctement et avec plus ou moins d'intensité.

Ces résultats, bien qu'imparfaits, sont extrêmement intéressants et il est permis d'espérer qu'ils pourront être bien améliorés.

Paris, le 22 Octobre 1915

Le Lieutenant-Colonel du Génie FERRIÉ, Directeur technique de la Radiotélégraphie Militaire.

Ferrié

OFFICIAL CONFIRMATION

Statement by Lieutenant-Colonel Ferrié regarding the successful reception in Paris of speech transmitted from the United States

ent effect. Finally Shreeve played his trump card. He writes:

> I then remembered the letter of introduction which had been given me by Mr. Thayer and I asked him if he could read English. He said that he could and I handed him the letter. He grabbed it upside down, looked at it for a minute and then returned it to me saying it was all right.

Shreeve and Curtis had had a similar experience with a country constable while on leave in England during a period when experiments at the Eiffel Tower were suspended.

So matters went on, with the monotony of their long wait lightened for the two American engineers only by an occasional incident such as that above described. They had resumed listening in September, but heard nothing from Arlington until early October, when on several occasions they thought they heard the sounds of a voice counting "One, two, three, four, five," etc.

When History Was Made

ON October 21, 1915—now recognized as one of the historic dates in communication history—successful reception, capable of full verification, was achieved. On that date the listeners in Paris heard B. B. Webb, at the transmitter in Arlington, speak the words, "Good-bye, Shreeve." These were several times repeated.

Shreeve at once cabled to Frank B. Jewett, reporting this reception, and asking if the message could be confirmed. Jewett could confirm it, and did. The long vigil at Paris was ended. The voice of man had been carried by radio telephony across the Atlantic!

All that remained now was to obtain from General Ferrié a statement certifying that he, too, had heard speech transmitted from Arlington to Paris. This Shreeve did, and, after obtaining the authority of the proper French officials, hurried off to get it on the cables to the United States, so that it might be included in a statement to the press which it was proposed to release immediately. The New York papers of the next day headlined the dramatic story of how human speech had leaped the Atlantic.

A great pioneering adventure had been carried to success—a success that had been made possible only by the patience, the painstaking attention to a multitude of details, the endurance, the resourcefulness and the unwavering enthusiasm of a group of men who for months had given all they had to a Thing in which they profoundly believed.

All of which is important for only one reason, for history has significance only in so far as it may be related to the present. That reason may be briefly stated: Behind and beneath the qualities which made it possible for these pioneers in radio telephony to accomplish what they did lay a spiritual something that still inspires those of them who are yet in the telephone service, as they go about their daily duties; that inspires others who share with them the responsibilities of the laboratory or the field—the hundreds of Bell System scientists and engineers who spend their working lives in a quest of means by which the value of America's telephone service to its users may be constantly increased.

MAKING TELEPHONE DIRECTORIES BETTER

Type, Paper, Covers, Informative Material Are All Under Constant Review and Frequent Improvement to Make This Important Element of Telephone Service More Satisfactory to Its Users

By OTIS M. HANCOCK

THE BELL SYSTEM publishes about 2,200 different telephone directories. They range in size from two-page cards with a few listings to the Chicago alphabetical directory of 1,500 pages, each of which contains about 450 listings. About thirty million directories are printed each year, and on many hundreds of thousands of telephone calls each day the directory is the first point of contact between the customer and the telephone company. Since the planning and production of these directories are an important part of the System's constant effort to make telephone service more and more pleasing and satisfactory to the user, they are the subject of continuous study by the directory organizations of the Associated Companies which publish them, as well as by the staff engineers of the American Telephone and Telegraph Company.

In considering the quality and adequacy of directory service, it is natural to think first of the results as measured by technical standards: listing errors, delivery failures, production time, etc. These technical results are very important, because the value of the customer's telephone service is affected adversely if his listings are in error or if he fails to receive his new directory promptly.

Of equal importance, however, and possibly of more concern to all telephone users, is what may be called the physical characteristics of directories. While such things as type face, cover and text paper, introductory page and miscellaneous information, cover design, etc., do not have any bearing upon the technical accuracy of the customer's directory or of his telephone service, they do affect the facility with which he may use his directory, and thus influence his satisfaction with telephone service. It is therefore the purpose of this article to review some of the things which have been done or are being done to improve directories from the standpoint of their appearance, physical characteristics, and general service value.

ONE of the most important problems which those charged with the responsibility for telephone directories have had to face is the selection of

type for the listing pages. In the early days of the telephone business, when customers were few and directories small, almost any type face which the printer happened to have available served the purpose. But, as the telephone business grew, and the directories became larger and larger, there developed a need for type faces which would be easy to read and yet provide the maximum number of listings on each page, in order to keep the directories down to a conveniently usable size.

About 1915 the Bell System engaged type experts who, working with type manufacturers, studied and tested many different type faces. From these tests there was developed a special type face for directories. This type served its purpose well, and was used for many years in the larger directories. Later a similar type face was developed in slightly larger size for use in the smaller directories. During subsequent years, the possibility of further improving these special directory type faces was kept constantly in mind. All current developments in typography and printing were carefully watched, and new designs of type analyzed for their appropriateness for directory use. Some modifications in letters and numerals were made from time to time as a result of these studies.

In 1937 the New York Telephone Company was faced with the necessity of resetting all the listings in its New York City directories. Before doing

La Rue W H r 903 State....MA in-1874
Larue W K groc 1916 Walnut....CO ngress-7942
Laundry Airdry 612 Clark....NO rth-10126
Le Blanc Inc 1361 Grant av....BE lmnt-8839
Leblanc J phys 1422 Park av....MY stic-5940
Lee Hong 3905 State....Ⓣ Milton-1012-W
Lee Wa Co 4289 Clark....LI ncoln-2951
Leroy F H r 121 North....BE lmnt-3071
Le Roy G H meats 435 Arnold....WE st-0506
Lincoln A & Bros 8323 Grant av....BE lmnt-5290
Lincoln A & Co 3289 North....CO ngress-3932
Lincoln A Inc 144 Walnut....WE st-1043
Lincoln A & Son 427 Beacon....LI ncoln-1565
Lincoln A & Sons 30 Clark....NO rth-3315
Lincoln A & Sons Co 581 Arnold....Ⓣ Milton-2000
Lincoln A Jos r 1918 Beacon....MA in-0266
Lincoln Bradley B r 7414 Park av....AD ams-1688
Lock Port Fisheries 501 Beacon....BE lmnt-3932
Lockport Engine Co 781 Walnut....MY stic-2401
Long Low Tai r 136 Arnold....MA in-6318
Looman Geo r 1593 McAllister....WE st-2336
Louisville Varnish Co 628-3rd....KA rny-2200
Love G A Sons contrs 378 Diamond....MI ssion-3562
Lowrey Alan J ofc 331 Montgomery....SU ttr-0130
Lowry H lds furnshngs 2447-44th....MI ssion-4069
Lucas M soft drinks 2301 Market....PA rk-7914
Lunsmann A W groc 447 Irving....SU nset-2461
Lurch Clara Mrs r 74 Portola....MA rket-3484
Lutz & Fritsch violins 45 Geary....DO uglas-2127
Lux Hand Lndry 316 Eddy....FR ankln-0165
Mabury Oliver nurse 721 Park av....LI ncoln-5290
MacDonald A J r 847 Grant av....WE st-5290
Macdonald B J groc 51 State....BE lmnt-4634
Mace L V r 1360 Arnold....CO ngress-1547
Macomber A A r 15 Grant Av....AD ams-4211
Mansfield Walter atty 1210 ParkAv....BE lmnt-5934
Mark-Off Shoe Co 124 North....MY stic-9728

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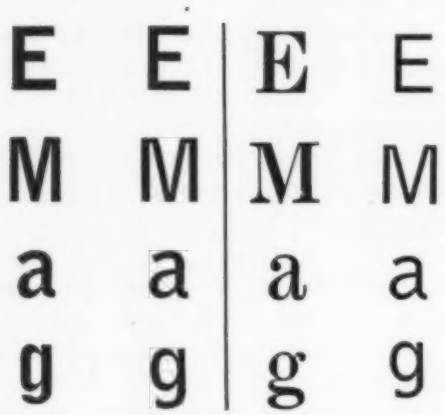
Mark-Off Shoe Co 124 North....MY stic-9728

OLD AND NEW DIRECTORY LISTING TYPE FACES

The column at the right is set in the specially developed "Bell Gothic"



DESIGN DETAILS ENLARGED

Examples of the simpler, more open, and therefore more legible "Bell Gothic" type (at the right in each pair). The pair at the left represents an enlargement of the former and present type face used for names; at the right, for addresses

so, it undertook to see what could be done to improve further the directory type then in use. Working with the Mergenthaler Linotype Company, the directory engineers altered a number of the characters by opening up the inside of the type to permit more white space to show through, and eliminated all serifs from the type used for the address portion of the listing. Thereby they derived a new type face which was more clean cut and appeared larger than the type formerly used—although it actually required no more space. As a result, individual listings were more legible and the directory as a whole was improved in appearance. This new type, known as Bell Gothic, has been made available in three sizes. It has already been adopted in about 700 directories, including practically all of the large city books, and has met with immediate favorable reaction from the public and the press.

Directory Paper

LIKE the type, the current blue-white paper used in telephone directories is the result of numerous improvements made during the past several years.

While telephone directories printed on a good grade of book paper might be impressive, it became evident many years ago that this would be impractical, since the thickness of book paper would increase the size of directories to the point where they would be too big to be usable or would have to be split into a number of volumes, which would be inconvenient from the customers' viewpoint. As a consequence, directory people turned to the type of paper ordinarily used in newspapers as a starting point in the development of a satisfactory paper for directory use.

A recent article in the QUARTERLY * described how Bell System engineers, working with the paper manufacturers, developed methods for the bleaching of pulp, the filtering of water, the selection of fillers and the establishment of specification controls which have resulted in a directory paper which meets exacting requirements as to color, cleanliness, thinness, opacity, and sturdiness, and yet is not unduly costly. During the past few years, changes in the ingredients of the paper or in the manufacturing processes have been made four different times, each resulting in a distinctly better stock. At the present time research is being directed toward increasing the opacity of the yellow paper used for the classified sections, in order to im-

* "Directory Paper Purchasing," QUARTERLY, April, 1939.

prove the general appearance of these pages and to increase the attractiveness of the "yellow pages" to business customers as a desirable advertising medium.

Similarly, directory cover paper is studied to take advantage of any possible improvements in the quality of the stock, its appearance and printability. Recently a study was made of the effect of different dyes and different surface finishes on the general tone of the cover paper. As a result, two new colors, buff and gray, were selected which, with the green formerly used, have been accepted by the Associated Companies as standard for future use. These new colors, when printed with an attractive cover design, greatly improve the appearance of the directories.

Introductory Pages

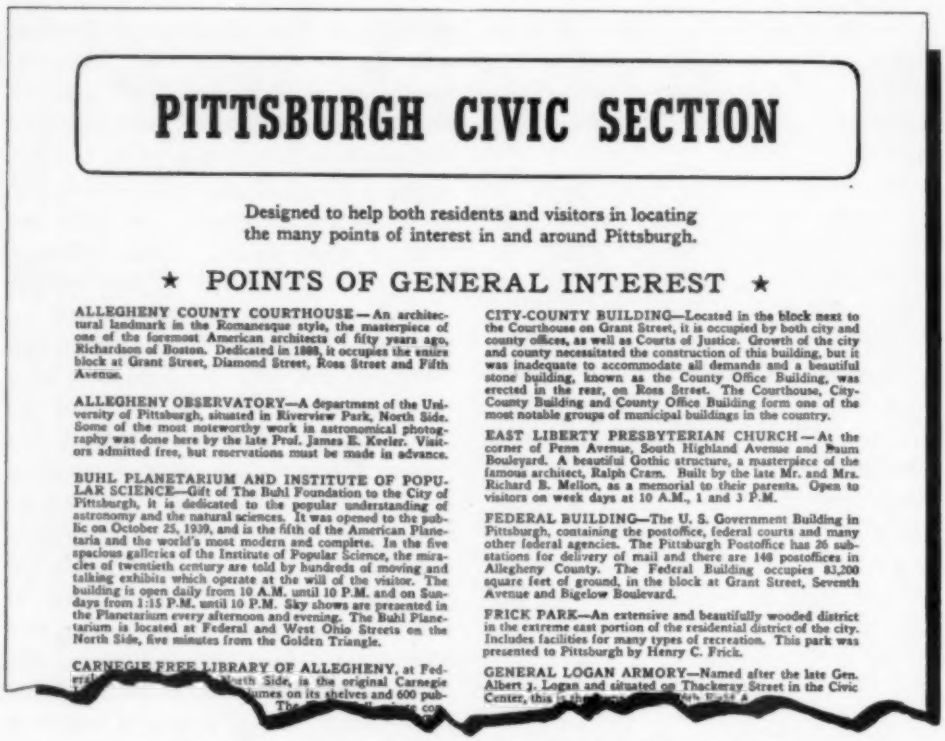
FROM the very beginning of the telephone business it has been the universal practice to devote the first few pages of the directory to general information regarding the telephone and its use. For many years this material consisted largely of detailed and often somewhat technical directions for making telephone calls, together with the rules and regulations applying to the furnishing and use of the service. Recognizing that the need for much of this type of information no longer generally exists, the telephone companies in recent years have made important revisions in these pages.

Page 1 is used uniformly now to list emergency call numbers such as Fire, Police, and Ambulance, and for service calls, that is, calls to the telephone company. Many of the companies also include on Page 1 an index to the material on the following introductory pages. A typical current introductory-page section includes information on how to transact business with the telephone company, brief instructions on how to dial, and a description of the types of out-of-town calls and how to make them. Then follows a page or two devoted to the various classes of telephone services and instruments available for the home and business, and how the customer may make us of them to get the most out of his telephone service. All of this material is carefully edited to eliminate technical language so far as possible, and the text is liberally illustrated. Great care is taken in the selection of type and the design of the pages to insure easy reading and attractive appearance. Some of the Associated Companies print these pages on a special color of paper to add to their attractiveness and to encourage their use.

Civic Information in Directories

A NEW feature of telephone directories adopted by many of the Associated Companies, which has resulted in many expressions of approval from the public, is the inclusion of a certain amount of non-telephone information of general interest. This feature has been developed as a result of evidence that the public looks to the telephone company for certain services which go somewhat beyond the rendering of satisfactory telephone service, and appreciates the value, convenience, and accessibility of the telephone directory as a place to publish appropriate miscellaneous information.

The information carried in the directories includes such material as



PITTSBURGH CIVIC SECTION

Designed to help both residents and visitors in locating the many points of interest in and around Pittsburgh.

★ POINTS OF GENERAL INTEREST ★

ALLEGHENY COUNTY COURTHOUSE—An architectural landmark in the Romanesque style, the masterpiece of one of the foremost American architects of fifty years ago, Richardson of Boston. Dedicated in 1888, it occupies the entire block at Grant Street, Diamond Street, Ross Street and Fifth Avenue.

ALLEGHENY OBSERVATORY—A department of the University of Pittsburgh, situated in Riverview Park, North Side. Some of the most noteworthy work in astronomical photography was done here by the late Prof. James E. Keeler. Visitors admitted free, but reservations must be made in advance.

BUHL PLANETARIUM AND INSTITUTE OF POPULAR SCIENCE—Gift of The Buhl Foundation to the City of Pittsburgh, it is dedicated to the popular understanding of astronomy and the natural sciences. It was opened to the public on October 25, 1939, and is the fifth of the American Planetaria and the world's most modern and complete. In the five spacious galleries of the Institute of Popular Science, the miracles of twentieth century are told by hundreds of moving and talking exhibits which operate at the will of the visitor. The building is open daily from 10 A.M. until 10 P.M. and on Sundays from 1:15 P.M. until 10 P.M. Sky shows are presented in the Planetarium every afternoon and evening. The Buhl Planetarium is located at Federal and West Ohio Streets on the North Side, five minutes from the Golden Triangle.

CARNEGIE FREE LIBRARY OF ALLEGHENY, at Fed- [illegible] Side, is the original Carnegie [illegible] umes on its shelves and 600 pub- [illegible]

CITY-COUNTY BUILDING—Located in the block next to the Courthouse on Grant Street, it is occupied by both city and county offices, as well as Courts of Justice. Growth of the city and county necessitated the construction of this building, but it was inadequate to accommodate all demands and a beautiful stone building, known as the County Office Building, was erected in the rear, on Ross Street. The Courthouse, City-County Building and County Office Building form one of the most notable groups of municipal buildings in the country.

EAST LIBERTY PRESBYTERIAN CHURCH—At the corner of Penn Avenue, South Highland Avenue and Baum Boulevard. A beautiful Gothic structure, a masterpiece of the famous architect, Ralph Cram. Built by the late Mr. and Mrs. Richard B. Mellon, as a memorial to their parents. Open to visitors on week days at 10 A.M., 1 and 3 P.M.

FEDERAL BUILDING—The U. S. Government Building in Pittsburgh, containing the postoffice, federal courts and many other federal agencies. The Pittsburgh Postoffice has 26 substations for delivery of mail and there are 148 postoffices in Allegheny County. The Federal Building occupies 83,200 square feet of ground, in the block at Grant Street, Seventh Avenue and Bigelow Boulevard.

FRICK PARK—An extensive and beautifully wooded district in the extreme east portion of the residential district of the city. Includes facilities for many types of recreation. This park was presented to Pittsburgh by Henry C. Frick.

GENERAL LOGAN ARMORY—Named after the late Gen. Albert J. Logan and situated on Thackeray Street in the Civic Center, this is [illegible]

TYPICAL OF A NEW FEATURE IN DIRECTORIES

Part of the first page of a section such as is being introduced between the alphabetical and classified sections in many books. Other topics in the Pittsburgh Civic Section are: historic shrines, education and the arts, public libraries, office buildings, national and state parks and recreation areas, and postal information

maps showing city streets, with the main transportation arteries; postal information; the location of principal office buildings; the location of public libraries and branches, together with their open hours and regulations applying to the borrowing of books; traffic rules and regulations; points of local historical interest, with pertinent information concerning each; and selected economic data for the community. The amount and scope of such information varies, of course, according to the size and type of community served by the directory. It may range from two pages to eight or ten pages for the large books. In many instances the information in these so-called "Civic Sections" has been related to local civic activities such as, for example, the featuring of traffic rules and regulations during local safety campaigns, or of material devoted to the historical background and the development of the community, both commercially and culturally, during centennial celebrations, etc.

The response of the public to these civic sections has been extremely favorable. Customers not only feel that the telephone company is taking a real interest in their home cities, but much

of the information has been found of considerable usefulness, particularly such things as the maps, indexes to streets, locations of office buildings, etc. In one resort city some of the hotels instructed their bellboys, when showing guests to their rooms, to open the telephone directory to the civic section and suggest that the guests familiarize themselves with the local points of interest. In another city several doctors commented that they had found the index to the location of streets particularly helpful when called to sections of the city with which they were not familiar. Municipal governments, civic bodies, post office departments, and other public utilities have coöperated wholeheartedly both in developing the information shown and in calling attention to its availability in directories.

Civic information is generally placed on the first pages of the classified section of the directory. In this location, public reference to this section is increased and thus they tend to become a more familiar daily convenience. This in turn should stimulate a greater use of the classified sections for finding both telephone numbers and buying information.

Toll Rates in Directories

ANOTHER recent development is the use of the inside front covers of directories for showing toll rate information. For several years Bell System national toll advertising, in addition to being designed to impress customers with the ease of telephoning out of town, has emphasized the low cost of the service, and advertisements have sometimes quoted typical point-to-point rates. Despite this, many telephone users are still under the impression that long distance rates are higher than is actually the case. While a certain number of typical toll rates have always been included in most directories, and toll advertising has often asked the customer to refer to his local directory, there has been no direct reference heretofore because there was no one standard place in all directories where customers could be told to look for rates from their own telephones. With this in mind, the suggestion was made in 1939 that the inside front cover of all directories be reserved for a table of toll rates. This would make possible the inclusion in both local and national toll advertising some such line as "See inside front cover of your directory for rates from your city." The inside front cover was chosen because it is a prominent location, easy to find in all directories, and it avoids complications which might arise from the selection of any other page because of the varying number of pages in directories of different sizes.

This suggestion was quickly adopted, and at the present time over 75 per cent of all Bell System book-type directories show a list of typical toll rates on the inside front covers. This year, for the first time, national toll advertising will include reference to rate information in that location. Directories are thus used to localize the Bell System's national advertising in much the same way that other national advertisers utilize Trade Mark Service in the classified sections of directories to increase the effectiveness of their advertising in other media.

"WHERE TO, PLEASE?"

"I'm your Long Distance operator. I'll take you almost anywhere you want to go—quickly, easily, inexpensively. Rates to many out-of-town points are listed below. If there are any others you would like to know, just ask me. (Dial 211)"

TYPICAL RATES FROM MANHATTAN TO OUT-OF-TOWN POINTS

RATES ARE FOR 3 MINUTES (On Station-to-Station Calls of 25 Cents or Less, 3 Minutes) and in addition on calls costing from $.30 to $.99, federal tax is 10 cents; from $1 to $1.99, tax is 15 cents; $2 and over, 20 cents.
NIGHT AND SUNDAY RATES APPLY FROM 7 P. M. TO 4:30 A. M. AND ALL DAY SUNDAY

From MANHATTAN* to:	STATION-TO-STATION		PERSON-TO-PERSON	
	WEEK-DAYS	NIGHTS AND SUNDAY	WEEK-DAYS	NIGHTS AND SUNDAY
Akron, Ohio	$1.40	$ .85	$1.85	$1.30
Albany, N. Y.	.75	.45	1.05	.75
Albuquerque, N. M.	5.00	3.25	6.75	4.75
Allentown, Pa.	.50	.35	.70	.55
Amityville, L. I.	.30	.30	.40	.40
Asbury Park, N. J.	.35	.35	.50	.50
Atlanta, Ga.	2.25	1.35	2.95	2.10
Atlantic City, N. J.	.55	.35	.75	.55
Babylon, L. I.	.35	.35	.50	.50
Baltimore, Md.	.75	.45	1.05	.75
Bayonne, N. J.	.10	.10	.20	.20
Bay Shore, L. I.	.35	.35	.50	.50
Bennington, Vt.	.70	.45	1.00	.75
Birmingham, Ala.	2.50	1.50	3.25	2.25
Bloomfield, N. J.	.15	.15	.25	.25
Boise, Idaho	5.75	3.75	7.75	5.75
Bosonia, N. J.	.30	.30	.40	.40
Boston, Mass.	.80	.50	1.10	.80
Bridgeport, Conn.	.40	.35	.55	.50
Bronxville, N. Y.	.20	.20	.30	.30
Buffalo, N. Y.	1.25	.75	1.65	1.15
Burlington, Vt.	1.00	.60	1.35	.95
Butte, Mont.	5.75	3.90	7.00	5.25
Cedarhurst, L. I.	.15	.15	.25	.25
Charleston, W. Va.	1.45	.90	1.95	1.40
Charlotte, N. C.	1.70	1.05	2.25	1.60
Cheyenne, Wyo.	4.50	3.00	6.00	4.50
Chicago, Ill.	2.20	1.35	2.95	2.10
Cincinnati, Ohio	1.80	1.10	2.40	1.70
Cleveland, Ohio	1.40	.85	1.85	1.30
Cliffside, N. J.	.10	.10	.20	.20
Columbia, S. C.	1.85	1.15	2.45	1.75
Columbus, Ohio	1.50	.90	2.00	1.40
Concord, N. H.	.85	.50	1.20	.90
Denver, Colo.	4.50	3.00	6.00	4.50
Des Moines, Iowa	3.00	1.80	4.00	2.75
Detroit, Mich.	1.55	.95	2.05	1.45
Dumont, N. J.	.30	.20	.30	.30
Elizabeth, N. J.	.20	.20	.30	.30
Ellenville, N. Y.	.50	.35†	.75	.60†
Englewood, N. J.	.15	.15	.25	.25
Fargo, N. Dak.	3.50	2.10	4.50	3.00
Floral Park, L. I.	.15	.15	.25	.25
Freeport, L. I.	.25	.25	.35	.35
Garden City, L. I.	.20	.20	.30	.30
Glen Cove, L. I.	.20	.20	.30	.30
Great Neck, L. I.	.15	.15	.25	.25
Greensboro, N. C.	1.40	.90	1.95	1.40
Greenwich, Conn.	.25	.25	.35	.35
Hackensack, N. J.	.15	.15	.25	.25
Harrisburg, Pa.	$ .70	$ .45	$1.00	$ .75
Hartford, Conn.	.55	.35	.75	.55
Hastings, N. Y.	.20	.20	.30	.30
Haverstraw, N. Y.	.30	.30	.40	.40
Hempstead, L. I.	.20	.20	.30	.30
Hicksville, L. I.	.25	.25	.35	.35
Hoboken, N. J.	.10	.10	.20	.20
Houston, Texas	4.00	2.50	5.25	3.75
Huntington, L. I.	.30	.30	.40	.40
Indianapolis, Ind.	1.95	1.30	2.60	1.85
Jackson, Miss.	3.00	1.90	4.00	2.75
Jersey City, N. J.	.10	.10	.20	.20
Kansas City, Kans.	3.25	1.95	4.25	2.90
Kansas City, Mo.	3.25	1.95	4.25	2.90
Kearny, N. J.	.15	.15	.25	.25
Kingston, N. Y.	.55	.35	.80	.60
Larchmont, N. Y.	.20	.20	.30	.30
Leonia, N. J.	.15	.15	.25	.25
Liberty, N. Y.	.55	.35†	.80	.60†
Little Rock, Ark.	3.25	1.95	4.25	2.90
Long Beach, L. I.	.20	.20	.30	.30
Long Branch, N. J.	.30	.30	.40	.40
Los Angeles, Cal.	6.25	4.25	8.50	6.50
Louisville, Ky.	1.95	1.20	2.60	1.85
Lynbrook, L. I.	.20	.20	.30	.30
Manasquan, N. Y.	.20	.20	.30	.30
Manhasset, L. I.	.15	.15	.25	.25
Memphis, Tenn.	2.80	1.70	3.75	2.60
Miami, Fla.	3.25	1.95	4.25	2.95
Milwaukee, Wis.	2.30	1.40	3.00	2.10
Minneapolis, Minn.	2.90	1.75	3.75	2.60
Montclair, N. J.	.20	.20	.30	.30
Monticello, N. Y.	.50	.35†	.75	.60†
Morristown, N. J.	.30	.30	.40	.40
Mount Kisco, N. Y.	.35	.35	.50	.50
Mount Vernon, N. Y.	.15	.15	.25	.25
Newark, N. J.	.15	.15	.25	.25
New Brunswick, N. J.	.30	.30	.40	.40
Newburgh, N. Y.	.45	.35	.65	.55
New Haven, Conn.	.45	.35	.65	.55
New Orleans, La.	3.50	2.10	4.50	3.00
New Rochelle, N. Y.	.15	.15	.25	.25
Norfolk, Va.	1.85	.65	1.40	1.00
Norwalk, Conn.	.35	.35	.50	.50
Nyack, N. Y.	.25	.25	.35	.35
Omaha, Nebr.	3.25	1.95	4.25	2.90
Ossining, N. Y.	.30	.30	.40	.40
Oyster Bay, L. I.	.25	.25	.35	.35
Passaic, N. J.	.15	.15	.25	.25
Patchogue, L. I.	.45	.35	.65	.55
Paterson, N. J.	$ .20	$ .20	$ .30	$ .30
Peekskill, N. Y.	.35	.35	.50	.50
Pelham, N. Y.	.15	.15	.25	.25
Perth Amboy, N. J.	.25	.25	.35	.35
Philadelphia, Pa.	.45	.35	.65	.55
Phoenix, Ariz.	5.75	3.75	7.75	5.75
Pittsburgh, Pa.	1.15	.70	1.55	1.10
Plainfield, N. J.	.30	.30	.40	.40
Pleasantville, N. Y.	.30	.30	.40	.40
Port Chester, N. Y.	.25	.25	.35	.35
Portland, Maine	1.00	.60	1.35	.95
Portland, Ore.	6.25	4.25	8.50	6.50
Port Washington, L. I.	.20	.20	.30	.30
Poughkeepsie, N. Y.	.50	.35	.75	.60
Providence, R. I.	.70	.45	1.00	.75
Red Bank, N. J.	.30	.30	.45	.40
Reno, Nev.	6.25	4.25	8.50	6.50
Richmond, Va.	1.05	.65	1.40	1.00
Ridgewood, N. J.	.20	.20	.30	.30
Rochester, N. Y.	1.15	.65	1.55	1.05
Rockville Centre, L. I.	.20	.20	.30	.30
Rutherford, N. J.	.15	.15	.25	.25
Rutland, Vt.	.85	.55	1.20	.90
Rye, N. Y.	.25	.25	.35	.35
St. Louis, Mo.	2.60	1.60	3.50	2.45
St. Paul, Minn.	2.90	1.75	3.75	2.60
Salt Lake City, Utah	5.25	3.50	7.00	5.25
San Francisco, Cal.	6.50	4.25	8.75	6.50
Saratoga Spgs., N. Y.	.90	.55†	1.25	.90†
Scarsdale, N. Y.	.20	.20	.30	.30
Scranton, Pa.	.55	.35	.75	.55
Seattle, Wash.	6.25	4.25	8.50	6.50
Sioux Falls, S. Dak.	3.50	2.10	4.50	3.00
Springfield, Mass.	.60	.40	.85	.65
Stamford, Conn.	.30	.30	.40	.40
Summit, N. J.	.25	.25	.35	.35
Syracuse, N. Y.	1.05	.60	1.40	.95
Tarrytown, N. Y.	.25	.25	.35	.35
Teaneck, N. J.	.35	.35	.25	.25
Trenton, N. J.	.40	.35	.55	.50
Tuckahoe, N. Y.	.20	.20	.30	.30
Tulsa, Okla.	3.50	2.10	4.50	3.00
Union City, N. J.	.10	.10	.20	.20
Washington, D. C.	.85	.55	1.20	.90
Westfield, N. J.	.25	.25	.35	.35
Wheeling, W. Va.	1.25	.75	1.65	1.15
White Plains, N. Y.	.25	.25	.35	.35
Wilmington, Del.	.55	.35	.75	.55
Worcester, Mass.	.70	.45	1.00	.75
Yonkers, N. Y.	.35	.35	.25	.25

* If you are calling from uptown Manhattan, the rates may be somewhat different from those shown.
† From June 25 to Sept. 10 inclusive, reduced rates apply only from 6 p.m. Sunday to 4:30 a.m. Monday.

SEE PAGE 9 FOR ADDITIONAL LONG DISTANCE INFORMATION AND RATES TO POINTS OUTSIDE UNITED STATES

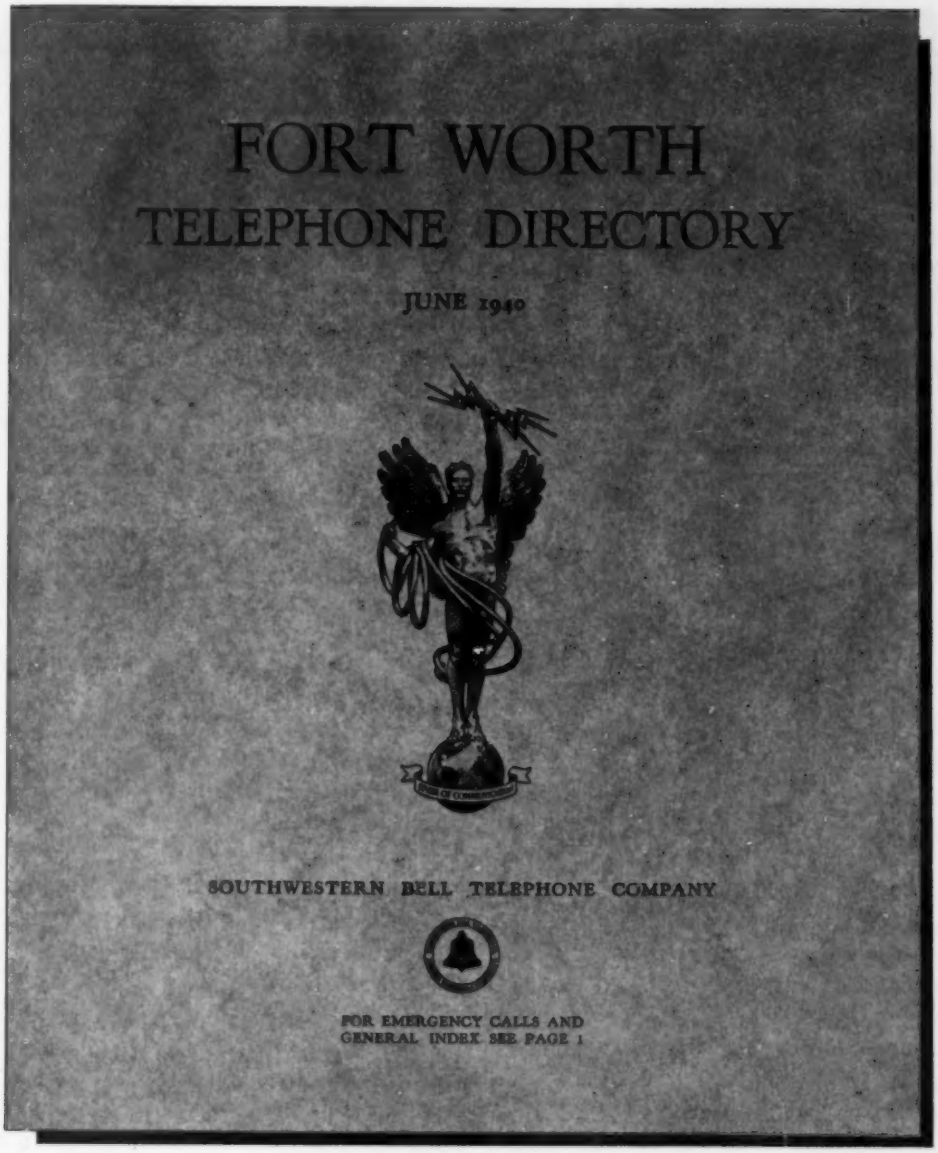
INSIDE FRONT COVER

This location is generally being adopted for toll rate information

Directory Cover Design

FOR a number of years the Associated Companies have been desirous of eliminating advertising from the front covers of directories, and of improving the appearance of the books by more attractive covers. Much progress has been made, and the companies have developed and used many attractive cover designs. More re-

cently, it was suggested that there would be advantages in a uniform front cover for all Bell System directories. All the then current covers were reviewed, together with other designs newly created for consideration, and a design was selected which was felt to be appropriate for the front covers of directories throughout the System.



STANDARD DESIGN

Bell System directories are gradually becoming everywhere identifiable as such

The central figure of this new standard cover is the symbolic figure, "The Genius of Electricity," which surmounts the Bell System headquarters building in New York City. As modified for reproduction on directory covers, the figure is identified as the "Spirit of Communication." More than half of all System directories now bear this common design on their front covers, and this number is expected to be largely increased during the present year. Bell System telephone directories will be readily recognizable as such to telephone users in any part of the country, and the new cover will doubtless have a definite recognition value in much the same way that the Blue Bell has come to be known everywhere as the sign of the public telephone.

IT is appropriate that this review of constant improvement in the planning and production of telephone directories should close with a reference to the symbolic figure of the "Spirit of Communication;" for it represents, when translated into action, the motives and the efforts of telephone people everywhere. To make telephone directories both more useful and more usable is all part of the obligation assumed by the Bell System in its pledge to provide "the best possible service." The record shows what has already been accomplished and is the sign that progress will continue.

HOW OUR POPULATION IS CHANGING

A Slower Rate of National Growth and of the Growth of Cities, and Other Significant Trends Revealed by the 1940 Federal Censuses, Are Important to the Telephone Industry

By ROBERT L. TOMBLEN

Some of the most revolutionary changes in American social history occurred during the 1930–1940 decade. Among the outstanding developments of this period were a greatly reduced population growth, with several states actually losing inhabitants; a sharp drop in the average size of the household, associated with a much more rapid rate of increase in number of families than in population; a drastic decline in city growth, due largely to a very marked slowing down in the rural-to-urban migration; the lowest rate of natural increase on record; and, for the first decade in history, a net outward migration from the United States. The returns of the 1940 Federal Census of Population, some of which are still preliminary, confirm and measure the changes which students of population have known were taking place in this country.

These developments are accounted for by a combination of unusual circumstances peculiar to the past decade and so pronounced in their effect upon national growth as to cause radical alterations in many previous population trends. Not only have past trends with respect to the size and geographical distribution of the telephone market undergone marked change, but the composition of this market has been vitally affected. The census data available at present permit only a quantitative analysis, but such an appraisal of population numbers and their location should prove helpful to the telephone industry in evaluating and anticipating future demands for its services.

National Population Growth

The total population of the United States on April 1, 1940, was 131,669,275, according to final returns of the Sixteenth Decennial Census. This figure represents an increase of 8,894,229, or 7.2 per cent, since 1930, as compared with a recorded growth of 17,064,426, or 16.1 per cent, between 1920 and 1930. The numerical gain between 1930 and 1940 is the smallest for any decade since the Civil War, and the per cent of increase is less than one-half of the lowest previous decennial rate in our national history.

The decline in the rate of popula-

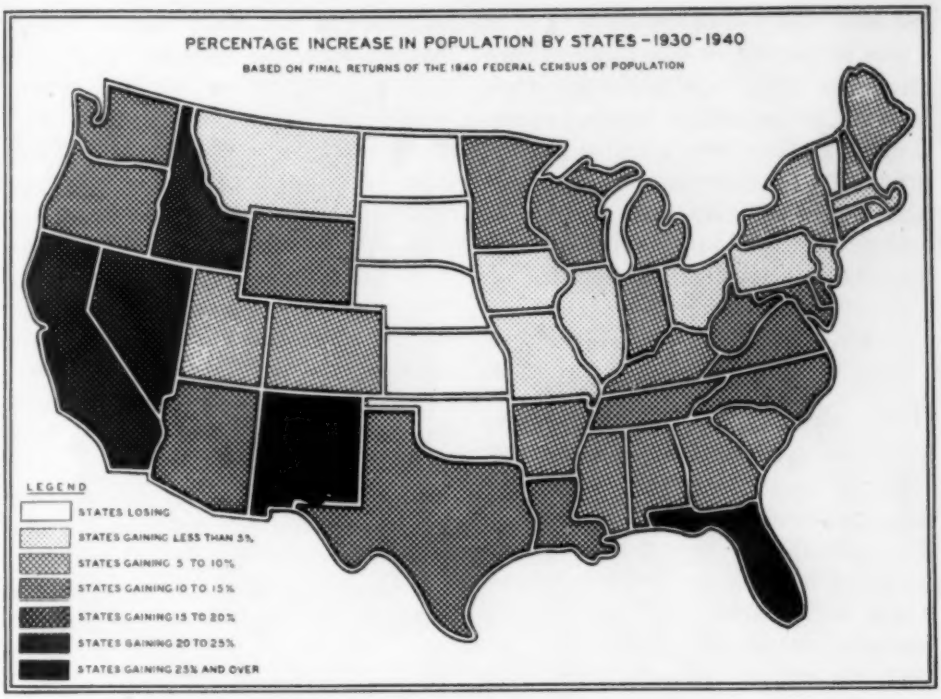
tion growth was foreshadowed by the annual Government reports on vital statistics and foreign immigration. The reports of the Commissioner of Immigration show an excess of emigration over immigration from 1930 to 1940 of about 200,000 (including United States citizens who departed permanently), as against a net immigration of approximately 3,000,000 between 1920 and 1930. The reports of the Bureau of Vital Statistics show an excess of births over deaths between 1930 and 1940 of about 8,100,000. (Exactly corresponding figures for the 1920–1930 decade are not available, because the registration areas for births and deaths were far from complete during that period.) The net gain in population between 1930 and 1940 indicated by data from these two sources was 7,900,000, or about 1,000,000 short of the recorded census growth.

There are several possible explanations for this apparent discrepancy, among which the following seem to be the most logical. First, an improvement in the efficiency of census enumeration, such as characterized the 1930 count, may have been in evidence again in 1940, with the result that the reported population gain may be somewhat greater than the real growth. While cities in the aggregate probably were enumerated with a degree of accuracy fairly comparable to the 1930 standard, many rural areas seem to have been canvassed relatively better in 1940 than they were in 1930. Second, there may be some justification for the theory that vital statistics, particularly births, are not fully reported, and that some allowance for under-registration should be made in the official figures, especially in regions where the completeness of registration is still subject to question. Finally, there is always the possibility that official immigration figures are too low because of unreported aliens who may have been smuggled into this country or who otherwise entered it illegally. The relative validity of these explanations cannot be determined with any degree of accuracy until such additional information as the age and nativity composition of the population is published.

Urban and Rural Population

FINAL figures indicate that the urban and rural populations grew at nearly equal rates during the past decade, 7.9 per cent for the urban and 6.4 per cent for the rural. This represents a sharp contrast with the 1920–1930 decade, when the rate of increase in the urban population was more than six times the rural rate. Since there was very little difference between the urban and the rural rates of increase in the 1930–1940 decade, the proportions of the total 1940 population that were urban and rural remain approximately the same as they were in 1930: about 56 per cent and 44 per cent respectively.

One of the principal explanations of the growth in rural population between 1930 and 1940 lies in the relatively large increase in the number of persons living on farms during the decade. In this connection it might be noted that the United States Bureau of Agricultural Economics has estimated the farm population on January 1, 1940, to be 32,245,000, the


PERCENTAGE INCREASE IN POPULATION BY STATES - 1930-1940
BASED ON FINAL RETURNS OF THE 1940 FEDERAL CENSUS OF POPULATION
LEGEND
STATES LOSING
STATES GAINING LESS THAN 5%
STATES GAINING 5 TO 10%
STATES GAINING 10 TO 15%
STATES GAINING 15 TO 20%
STATES GAINING 20 TO 25%
STATES GAINING 25% AND OVER

POPULATION CHANGES BY STATES

Percentage increases in the past decade ranged from 25 per cent and over (black) to minus figures (white)

largest in 24 years and close to the 1916 all-time high record of 32,530,000. The increase of 2,100,000 in farm population during the 1930's followed a decrease of 1,500,000 during the 1920's. Whereas the net migration from farms to cities during the 1920's was approximately 6,300,000, the corresponding figure during the 1930's was only 2,200,000 persons.

THIS difference was not due primarily to any substantial back-to-the-land movement largely offsetting the cityward migration, but to the fact that the farms retained a much larger proportion of their natural increase between 1930 and 1940 than in the preceding decade. Reduced employment opportunities in industry caused many young people to remain on farms who in normal times would have migrated to the cities. The number of youth reaching the age when migration is usually at its height increased during the past decade, and will continue to increase for several years more, as the effect of the peak in births of 1921–1925 is reflected in a correspondingly large number of young persons currently reaching maturity, when they ordinarily start out for themselves.

In some areas the greater utilization of abandoned or semiabandoned farms for subsistence farming by peo-

ple who returned to the country after a stay in the city, or who retained their city jobs while supplementing their incomes by incidental farming operations, may have been a factor in rural growth. Furthermore, Government agricultural policies have tended to make commercial farming increasingly attractive during the past decade.

Growth by States and by Major Regions

THE population growth between 1930 and 1940 was very unevenly distributed among the states and the principal subdivisions of the country. This situation is brought out graphically on map on the preceding page. These wide variations in population changes during the past decade reflect not only differences in rates of natural increase but also extensive interstate migrations.

The states east of the Mississippi River received a slightly smaller proportion of the national increase between 1930 and 1940 than their proportion of the actual population in 1930, while the group of states between the Mississippi and the Rocky Mountains, which contained one-fifth of the total population in 1930, received only one-eighth of the decade growth and the states from the Rockies to the Pacific, with less than one-tenth of the 1930 population, gained more than 22 per cent of the ten-year increase.

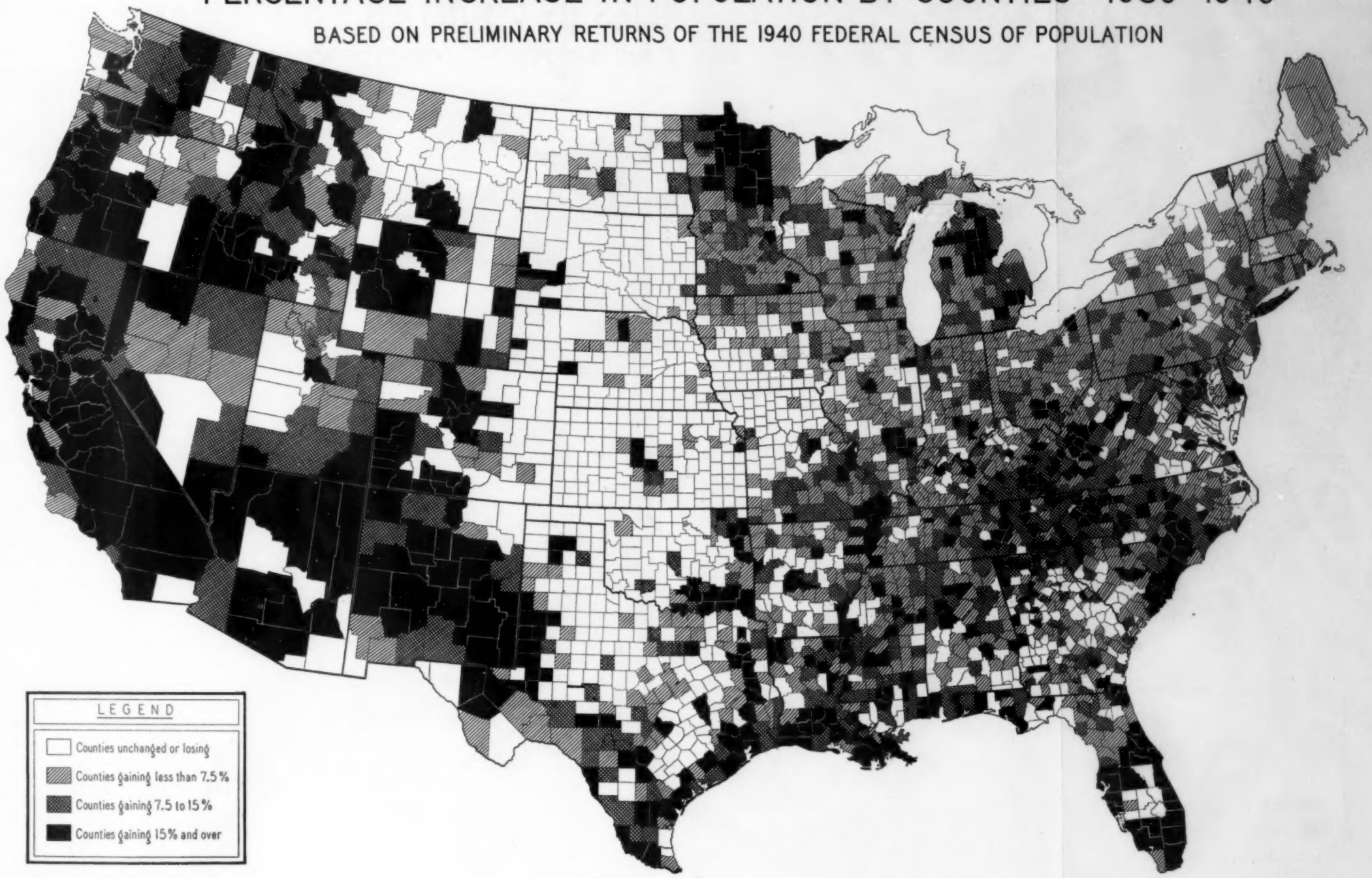
A further consideration of these broad areas according to the division of their population gains between natural increase and migration reveals some interesting differences. Population growth in the states east of the Mississippi was about equal to their natural increase, with no appreciable migration in or out of this general region. However, there were such marked differences in the rates of natural increase between the northern and southern sections of this region that all the southern states grew faster than the country as a whole, while the northern states, with the exception of Michigan, had rates of gain below the national average. Within this eastern region three areas were conspicuous in their relatively heavy gains from inward migration, namely, the New York and Washington metropolitan areas, and Florida. At the same time Pennsylvania, although gaining 270,000 population, experienced a net outward migration of nearly 300,000 residents, the largest loss from this cause for any state.

THE central belt of agricultural states retained only one-half of their natural increase, losing about one million persons through net outward migration to other states. Most of this loss occurred in five states: North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma. Each lost population, the aggregate loss amounting to over 300,000. Among the possible explanations of these losses were successive prolonged droughts, excessive soil erosion, and severe dust storms, along with increased mechanization of agriculture which contributed to consolidation of farms and to reduced labor needs.

The western group of states grew four times as fast as the central area, despite the lowest rate of natural increase among the three regions, and gained about one million new residents

PERCENTAGE INCREASE IN POPULATION BY COUNTIES - 1930 - 1940

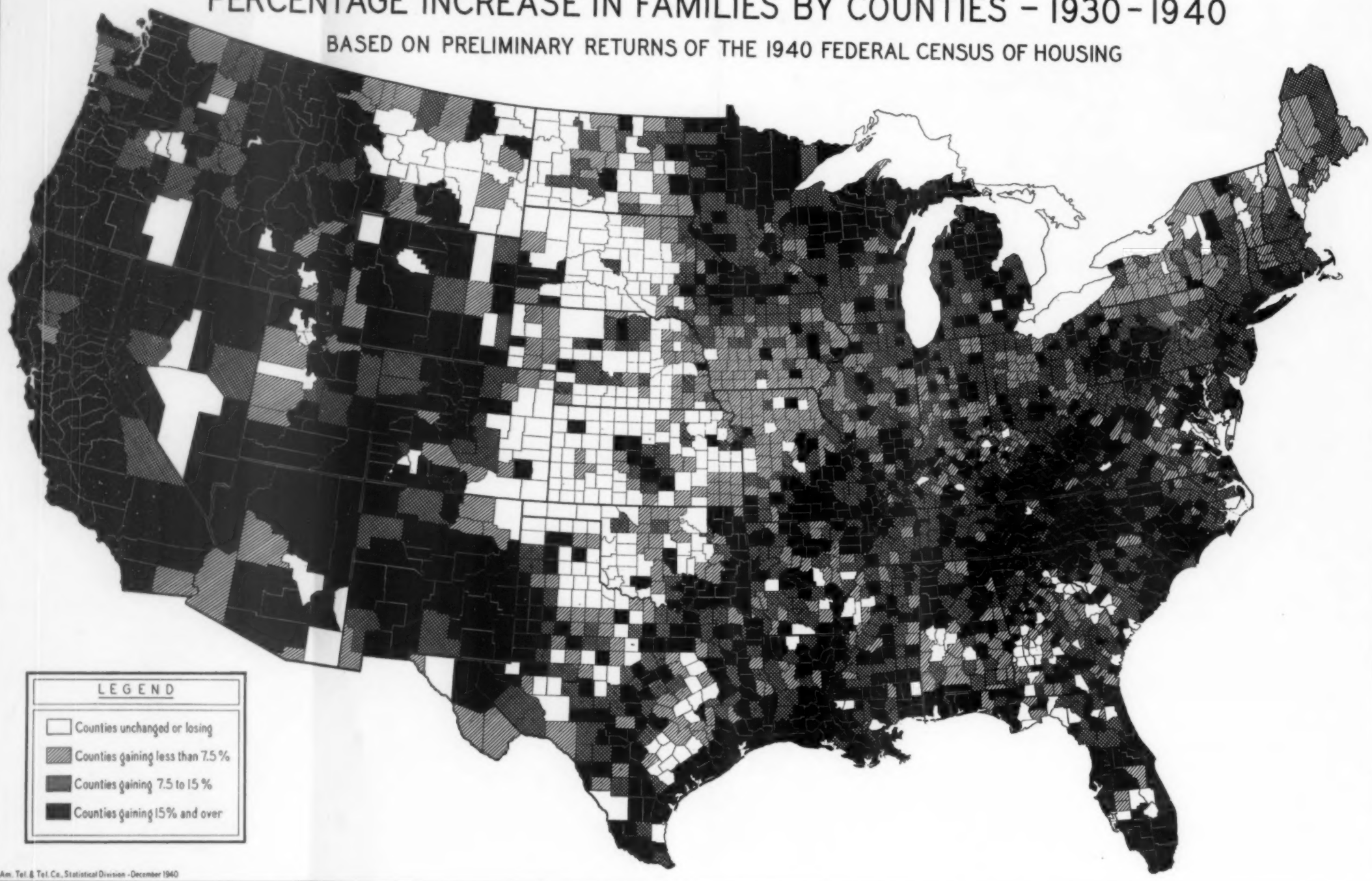
BASED ON PRELIMINARY RETURNS OF THE 1940 FEDERAL CENSUS OF POPULATION


LEGEND
Counties unchanged or losing
Counties gaining less than 7.5 %
Counties gaining 7.5 to 15 %
Counties gaining 15 % and over

Am. Tel & Tel. Co., Statistical Division - October 1940

PERCENTAGE INCREASE IN FAMILIES BY COUNTIES - 1930-1940

BASED ON PRELIMINARY RETURNS OF THE 1940 FEDERAL CENSUS OF HOUSING


LEGEND
Counties unchanged or losing
Counties gaining less than 7.5%
Counties gaining 7.5 to 15%
Counties gaining 15% and over

Am. Tel. & Tel. Co., Statistical Division - December 1940

from net inward migration. Indeed, all these states except Montana grew faster than the country as a whole. In absolute numbers the increase of population in California was considerably greater than that in any other state, amounting to slightly over 1,200,000 as compared with nearly 900,000 in New York, the next highest state in this respect. Among the reasons for the rapid growth of the western region, the greater activity in silver mining and the influx of refugees from drought-stricken areas were undoubtedly important factors. Of course, California, like Florida, benefited materially from the inward migration of the retired classes.

A MORE detailed picture of population changes between 1930 and 1940 is available from the census returns by counties. The map opposite page 50 shows the relative population gains by counties during the past decade.

There were 983 counties, or 32 per cent of the total number, that had fewer inhabitants in 1940 than 1930, in contrast with only six states that lost population. One-third of these counties were located in the losing states, while another third of them were distributed elsewhere in the central area. Indeed, a large majority of the counties between the Mississippi and the Rockies lost population during the past decade. Counties in this region that gained population were largely concentrated in the coastal area and the lower half of the Mississippi River valley.

Growth by Cities

THE material decrease in the rate of urban growth during the past decade is reflected in individual cities of all sizes throughout the country. The decline in the rate of growth between 1930 and 1940, as compared with the 1920–1930 period, was much more marked in the larger cities than in the smaller ones, however. The comparative figures for cities grouped according to size in 1930 are shown in the following table:

Size of City (Based on 1930 Population)	Percentage Gain	
	1920–1930	1930–1940
500,000 and over	23.8	3.7
100,000–500,000	23.2	5.4
50,000–100,000	28.9	4.2
25,000– 50,000	29.3	6.4
10,000– 25,000	31.2	8.3

With few exceptions, cities lost their drawing power for migrants from foreign countries, farms, and small towns. In fact, a large number of cities experienced a considerable net outward migration during the past decade. In many cases this migration exceeded their natural increase. Thus, 257 out of 982 urban places of 10,000 or more inhabitants in 1930 lost population between 1930 and 1940, whereas only 84 of the same communities declined in size in the preceding decade. Of the 93 cities having 100,000 or more inhabitants in 1930, 31 lost population during the past ten-year period. None of these big cities, except New Bedford, had ever recorded a loss in their entire history until the 1930–1940 decade. Among them are several of the largest cities in the country and they include such cities as Philadelphia, Cleveland, St. Louis, Boston, Newark, Kansas City (Mo.), Roches-

ter, Jersey City, Toledo, Akron, Syracuse, Worcester, and Youngstown. Almost all of these 31 losing cities are industrial centers located in the northeastern states. Furthermore, 33 of the 98 cities between 50,000 and 100,000 population in 1930 declined in size during the past census decade. In some instances, however, the inclusion of communities suburban to these cities would erase the losses by small margins. The aggregate urban growth is commensurate with national growth only because a few metropolitan areas gained heavily, usually for special reasons.

THERE are other factors in addition to the decline in the birth rate and the cessation of immigration that account for the marked changes in city growth. Some of the slow urban growth can be attributed to the reduction in employment opportunities caused by curtailed business activity and by decentralization of industry. Another factor can be found in the movement of population toward residential suburban communities which can easily be reached by train, bus, and automobile, and which combine lower living costs and other advantages to make life more attractive there than in the large city. Thus, all over the country the suburban areas outside the large and even moderate-sized cities have grown rapidly, while the central cities themselves have experienced little gain or have even decreased in size.

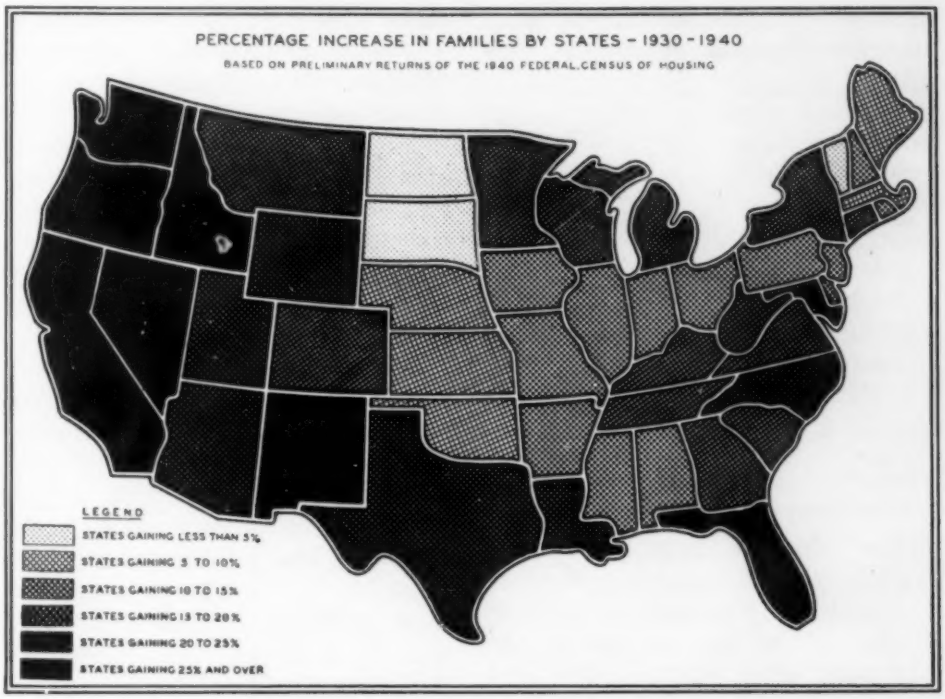
Of the cities which did experience growth, New York was first in numerical increase, while the next largest growth occurred in Los Angeles. Washington had the highest rate of growth among the large cities and also ranked third in amount of absolute gain, reflecting the great expansion of government activity during the decade. In this connection it is noteworthy that capital cities generally grew faster than their states, and considerably more rapidly than other cities in their size groups. This is shown in the accompanying table:

Size (in 1930)	Percentage Gain 1930–1940	
	Capital Cities	Other Cities
100,000 and over	8.4	3.9
50,000–100,000	12.7	2.9
25,000– 50,000	23.3	5.8
10,000– 25,000	23.1	8.0

Several other individual cities which experienced relatively large gains were in the coastal districts of Florida, Texas, and Southern California.

Family Growth

THE Housing Census, introduced in 1940 and taken in conjunction with the Population Census, has furnished data on occupied dwelling units, which are approximately equivalent to the private family, or household, of the 1930 census. Final figures now show that the total number of occupied dwelling units, or families, in the United States on April 1, 1940 was 34,861,625. This figure represents a growth of 4,956,962, or 16.6 per cent, since 1930. Since population increased during the same period at the rate of 7.2 per cent, as already cited, it is apparent that during the decade from 1930 to 1940 the number of families increased at a considerably faster rate than did population. Indeed, this relatively greater growth


PERCENTAGE INCREASE IN FAMILIES BY STATES - 1930 - 1940
BASED ON PRELIMINARY RETURNS OF THE 1940 FEDERAL CENSUS OF HOUSING
LEGEND
STATES GAINING LESS THAN 5%
STATES GAINING 5 TO 10%
STATES GAINING 10 TO 15%
STATES GAINING 15 TO 20%
STATES GAINING 20 TO 25%
STATES GAINING 25% AND OVER

ALL STATES GAINED FAMILIES

Note that, in contrast with the map on page 49, no state suffered a net decrease in families

in families occurred in every state with a remarkable degree of consistency. The same situation held true for more than 97 per cent of all urban places of 10,000 or more inhabitants. This development may be considered a favorable factor from the standpoint of the telephone industry, in view of the fact that the residential market for telephone usage is usually measured in terms of households rather than of individuals.

ALTHOUGH six states lost population between 1930 and 1940, every state gained families during this period. The accompanying map indicates, for each state, the rate of family growth within specified limits. A comparison of this map with the one on page 49 will emphasize the relatively greater growth in households than in individuals and will reveal that many states with only nominal population gains, or even decreases, experienced relatively substantial family increases.

Furthermore, while 983 counties had fewer persons in 1940 than they had in 1930, only 402 counties lost families during the same period. The map opposite page 51 shows the location of the counties that lost families between 1930 and 1940 and also the distribution of the counties that gained according to their relative rates of growth. The table on page 54 shows the marked contrast in the percentage changes in population and in families

by counties classified according to their rate of population gain.

Counties Classified by Their Rate of Population Gain	Number of Counties	Percentage Gain 1930–1940	
		Population	Families
Gaining Population:			
15.0% or more	558	26.3	36.2
7.5 to 15.0%	584	10.3	19.2
0 to 7.5%	947	3.6	12.8
Losing Population:			
0 to 2.5%	243	−1.1	8.3
2.5 to 5.0%	181	−3.5	4.9
5.0 to 10.0%	240	−7.0	2.5
10.0 to 20.0%	231	−13.5	−3.7
20.0% or more	88	−24.8	−14.9

The relatively larger growth of families than of population between 1930 and 1940 is reflected in the sharp decline in the average size of the household, which, for the nation as a whole, dropped from 4.10 to 3.78 persons. This change in the persons-per-family ratio was greater than in preceding decades and was due primarily to the cumulative effect of declining birth rates. Indeed, the number of adults per family has varied but little for several decades, while the number of children per household has declined steadily.

THE decline in the average size of family was quite substantial in most states, ranging from practically no change in the District of Columbia to 0.46 persons per family in North Dakota, 0.44 in Washington, and 0.42 in Montana and Utah. The smallest average households were in the Pacific Coast states, with 3.22 persons in Washington, 3.23 in California, and 3.24 in Oregon. The largest families were in the South, where the average ratios were 4.52 in North Carolina, 4.37 in South Carolina, 4.28 in West Virginia, 4.27 in Virginia, 4.20 in Alabama, and 4.15 in Georgia.

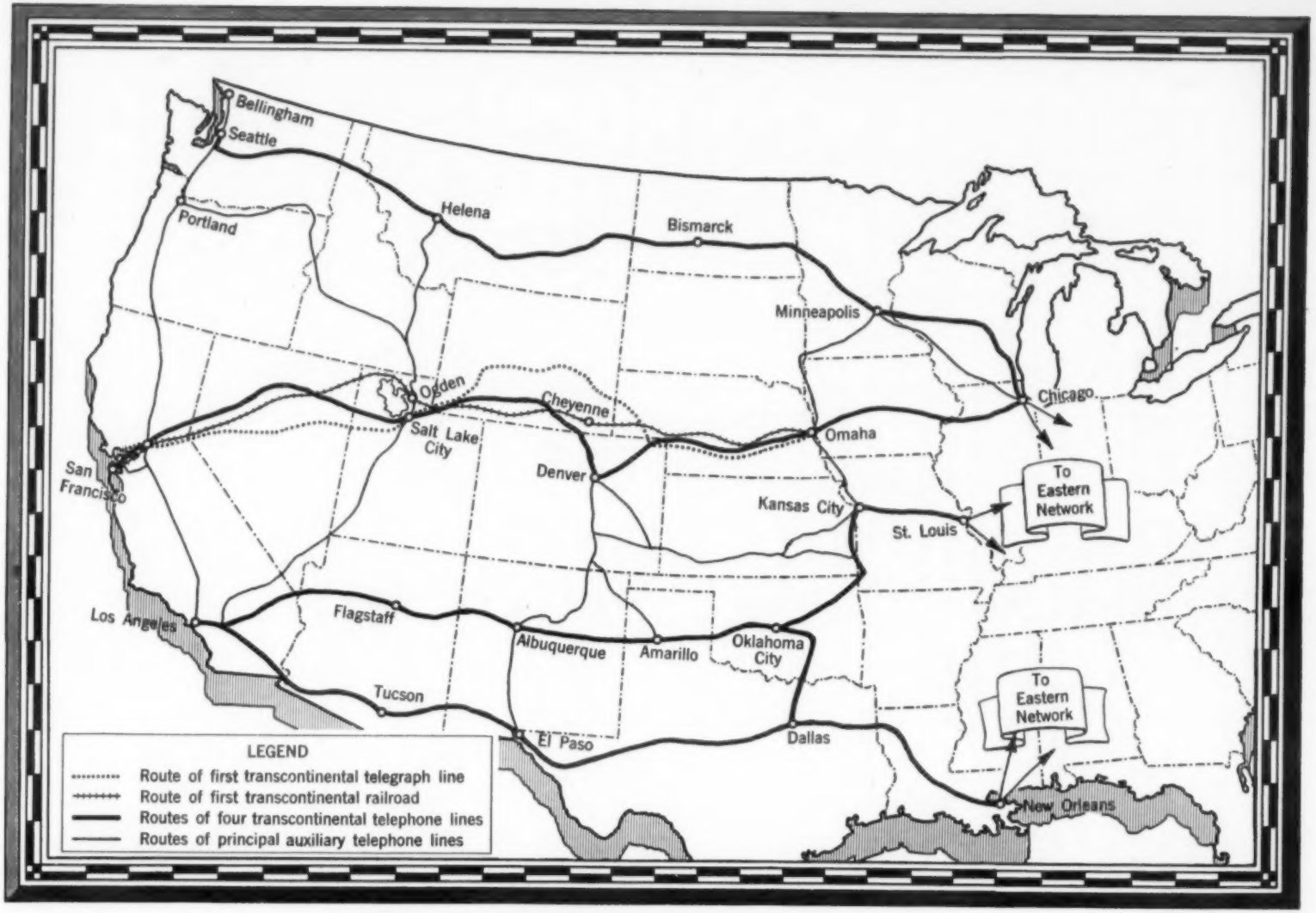
As perhaps might be expected in view of the more rapid decline in city birth rates, the change in the average size of household was more pronounced in urban than in rural territory. The number of persons per family dropped from 3.98 in 1930 to 3.60 in 1940 for incorporated places of 10,000 or more inhabitants, while the corresponding decline in all other places was from 4.23 to 3.96.

The increase in the number of families since 1930 greatly exceeded the number of family living quarters provided by new construction, as indicated by building permit data. This apparent deficiency in new building in addition to the large accumulation of vacancies among dwelling units reported by the Housing Census implies that many living quarters have been subdivided in order to provide more low-rent dwelling units. The families that have been obliged to occupy these smaller accommodations because of reduced income during the depression have in most cases been forced to adopt a lower standard of living and have thereby become relatively poorer prospects for telephone service.

The Picture as a Whole

THE most pronounced tendency indicated by the 1940 Federal Census is the sharp decline in the national rate of population growth to the lowest level ever experienced in this country. This is accounted for by the lowest rate of natural increase in our

national history and by the fact that for the first time on record emigration from the United States exceeded immigration. The number of families, however, increased relatively faster than population and so the average size of household dropped sharply. Sizeable shifts in population caused a considerable redistribution of people throughout the country, with marked gains occurring in some areas and large losses in other places. In contrast to the 1920–1930 decade, economic conditions between 1930 and 1940 were far less favorable to industrial activity and urban employment, with the result that there was a marked slowing-down in city growth, with many cities actually declining in size. Despite the rapid growth of some resort centers through the influx of tourists and retired classes, there has been a deterioration in living standards for large numbers of the population. All of these changes have a bearing on the market for telephone service, and consideration of them is important to the telephone industry in planning for additional facilities.



STEPS IN TRANSCONTINENTAL COMMUNICATION

THE CONQUEST OF A CONTINENT

The Successive Means Which Have Been Devised for Coast-to-Coast Communication Have Been Fundamental to the Growth of This Country and to Its Unity as a Nation

By ROBERTSON T. BARRETT

PART III*

PART I of the present article contained an outline of some of the social and economic factors which have led to the development of various means of transcontinental communication, and touched upon those facilities which antedated the use of steam for land transportation from coast to coast. In Part II, the roles played by the railroad and the airplane as factors in communication between the Atlantic and the Pacific were discussed. Thus we have considered those instrumentalities of communication which, beginning with the Pacific mail steamers of nearly a hundred years ago and ending with the air mail planes of today, have depended on the physical transportation of written messages. In this concluding section of the discussion, we turn to those products of man's inventive faculty which, in one form or another, have employed electricity for the transmission of intelligence over distances.

The first of these was the electric telegraph. We are not concerned with its invention, in the form that it took in America, by Morse; nor with the picturesque history of its development in the United States up to the point where its use was seriously considered as a means of transcontinental communication. Even when so limited, our subject takes us back more than eight decades.

If the name of Butterfield is to be linked with the Overland Mail, and that of Russell with the Pony Express, the name of Hiram Sibley should be forever associated with the building of the first telegraph line that connected the Atlantic and Pacific coasts. As early as 1857—hardly more than a dozen years after Morse's historic transmission of the sentence "What hath God wrought!"—this far-seeing ex-sheriff of Rochester, New York, was seriously proposing a coast-to-coast telegraph line. He submitted his project first to the Board of Directors of the Western Union Telegraph Company, of which he was president.

* Parts I and II appeared in the BELL TELEPHONE QUARTERLY for July and October, 1940.

SIBLEY's experience provides a striking example of what can be accomplished by one man when fired by an idea for which he is willing to fight. His proposal at first found his associates of the Western Union directorate so conservative as to drive him to the point of ill-concealed exasperation. It is said that in one of their early conferences, when the argument on his proposal had been particularly protracted, Sibley rose from his chair, stalked toward the door, turned and said crisply, "Gentlemen, if you won't join hands with me in this thing, I'll go it alone."

The hesitancy of those who objected to the proposal that the Western Union proceed with the project on its own account was not without justification in sound business judgment. Many of them shared with Sibley a conviction as to the importance of building a transcontinental telegraph line but, according to James D. Reid, in "The Telegraph in America," felt that "it was too hazardous a venture to be undertaken by a company having the care of so many interests, and which was not yet thoroughly established in some of its undertakings."

SIBLEY also proposed his plan to the North American Telegraph Association, an organization which included in its membership representatives of a number of companies not connected with the Western Union, at a meeting held in August, 1857. As such organizations still do, the association passed a resolution appointing a committee to devise measures by which the work might be prosecuted. And, as committees sometimes still do, the committee accomplished little or nothing.

Nevertheless, Sibley did not have to "go it alone," although he provided most of the driving force and enthusiasm which pushed his project forward to final fulfillment. To supplement the support which he hoped to get from private investors, he enlisted the coöperation of other Western Union directors in applying to the government for a subsidy to finance a part of the cost of the building of the line.

Aid from Congress

AT length, after Sibley, with the prestige of the Western Union behind him, had conducted a masterful campaign in Washington, an act of Congress was passed, on June 16, 1860, "to facilitate communication between the Atlantic and Pacific states by electric telegraph."

The following November 1, Salmon P. Chase, Secretary of the Treasury, executed a contract with Sibley, individually. Among its provisions were two of which the substance was as follows:

1. The line was to be completed within ten years following July 31, 1860.
2. The government was to pay a subsidy of $40,000 a year for ten years, to be "taken out in trade." In exchange for this subsidy, the government was given certain service preferences, and certain government bureaus or agencies were to be given free service, during the life of the subsidy.

Meanwhile, steps were under way that led to an arrangement which disposed of the most serious objections to Sibley's original plan. A separate

THE PONY EXPRESS SALUTES THE TELEGRAPH

This old drawing of the extension of the telegraph lines across the plains was originally published in Harper's Weekly

company was organized to undertake the building of the line westward toward the Pacific. This was the Pacific Telegraph Company. Its principal stockholders were largely directors of the Western Union, but its funds were provided by them as individuals, not by the Western Union as such.

Selection of a Route

MEANWHILE, too, Jeptha H. Wade, of the Western Union, had gone to California and presented the project to a number of telegraph companies which were operating independently of each other in that state. Catching some of Sibley's enthusiasm, as a result of Wade's conferences with them, the executives of these companies agreed upon a merger with the California State Telegraph Company. It was also agreed that this company should follow the example of the Western Union and organize a separate company—the Overland Telegraph Company—to build the line eastward.

The selection of a route was a difficult problem. This important phase of the work Sibley assigned to Edward Creighton, the only man whose training and experience qualified him for the task. After rejecting two alternative routes as being too long, Creighton personally surveyed the line finally chosen, beginning this historic piece of communication engineering on November 18, 1860. With the exception that its eastern terminus was Omaha, instead of St. Joseph, Missouri, this route substantially followed the route of the Pony Express, which we have already described. Creighton covered the distance from Omaha to Salt Lake City by stage coach, but

from this point westward he made the difficult journey alone, on the back of a mule. On the basis of his report, arrangements were pressed for beginning construction of the line at the earliest practicable date.

Building Begins

ACTUAL building began—as if in recognition of the important part the line was to play in the affairs of the nation—on July 4, 1861. Creighton himself took charge of operations for the Pacific Telegraph Company, which built westward from Omaha, his assignment covering a 700-mile stretch which was to connect with a 400-mile line to be built by Charles M. Stebbins, working eastward from Salt Lake City. The crews of the Overland Telegraph Company, in charge of James Gamble, began at Fort Churchill, which had previously been linked with San Francisco, and worked eastward to Salt Lake City, which was agreed upon as the point at which the eastern and western sections of the completed line were to meet. A bonus or prize was to be paid by the losers to the builders who reached that city in advance of the others.

But considerations more important than the winning of bonuses or prizes made speed the essence of success in this difficult task which was being undertaken. Issues between North and South had reached and passed the breaking point; Fort Sumter had been fired upon. It became doubly important that every possible link which would assure the loyalty of California and Utah to the Union be strengthened without delay.

To this critical need, both groups of builders responded with a will. Armies of men, oxen, mules, with necessary supplies and equipment, were put to work at different points of the line. Despite the natural difficulties inherent in the task of building a line through rough terrain, across a region largely uninhabited; despite misunderstandings with local contractors in Utah, who had agreed to furnish poles and then decided that the price which they had agreed upon was too low; despite mistrust, if not open opposition, on the part of the Indians, which required a high degree of diplomatic skill to overcome—despite all this, and much more, the line was built.

Completed in Record Time

AND it was built at a speed which made the ten-year limitation provided for in Secretary Chase's contract seem almost humorous, when contrasted with what was actually accomplished. On October 18, 1861, Creighton raised the last pole on the Omaha-Salt Lake City section of the line. On October 22, Gamble's men—who had worked through far more difficult country—reached Salt Lake City. On October 24, the Atlantic and the Pacific were linked by telegraph. To Abraham Lincoln, in the White House, there must have been special significance and special cause for gratitude in the words which the telegraph ticked off:

> "The people of California desire . . . to express their loyalty to the Union and their determination to stand by its government on this, its day of trial."

The cost of building the line was estimated, in advance of construction,

PONY EXPRESS, OVERLAND MAIL, TELEGRAPH

These three modes of communication, contemporaneous for a brief interval, are here pictured by William H. Jackson, Secretary of the Oregon Trail Memorial Association, at the Red Buttes stage and pony express station

at between $400,000 and $600,000. Probably its actual cost was nearer the latter figure than the former. The expense of maintaining the line was estimated at $150,000 a year.

Determining the rates which should be charged for telegrams over the coast-to-coast line was a difficult problem. Few, if any, of the communication services which had hitherto been established across the continent had paid their own way, and it seemed probable that, even with the government subsidy, this might be the case with the transcontinental telegraph, unless in fixing the rates a wise balance could be maintained, with due regard to the investment in the line, the value of the service, and the public demand for it. The rates finally fixed, for telegrams from San Francisco to the following points, were:

	Ten words	Additional word
St. Louis	$5.00	$.45
Chicago	5.60	.40
New York	6.00	.75
Boston	7.00	.60

One measure of the advances that have been made in the communication art since the building of this pioneer transcontinental telegraph line may be had by contrasting the above rates with those now in effect. The Western Union's present rate between San Francisco and St. Louis or Chicago is $.90 for the first ten words and six cents for each additional word. Between San Francisco and New York or Boston, the rate is $1.20 for the first ten words and eight and

one-half cents for each additional word. These rates are for regular telegraph messages. Day letters and overnight telegrams may be transmitted considerably more cheaply.

Modern Telegraph Facilities

BUT the cost of a communication service is never the full measure of its value. The expense of transmitting President Lincoln's annual message of 1862 from Washington to San Francisco is stated to have been $600—which was not considered too high a price at a time of crisis when every word of the national executive was fraught with meaning. Similarly, the importance of the role played by the facilities provided by the two principal telegraph companies which serve America today cannot be gauged by the cost of sending any particular telegram, nor by the total sums paid to them each year for their services.

Statistics afford some measure of the extent of these services, to be sure. According to the Federal Communication Commission's "Selected Financial and Operating Data from Annual Reports of Telegraph, Cable and Radiotelegraph Carriers" for the year ended December 31, 1938 (the most recent available at the time of writing) the Western Union Telegraph Company had operated during that year a total of 213,123 miles of pole line; 5,005 miles of single-duct underground conduit; 3,713 independent and 16,258 joint telegraph offices. It had handled during the year 146,063,679 domestic telegraph revenue messages. During the same period the Postal Telegraph-Cable Company's land line system had operated 32,094 miles of pole line; 1,104 miles of single duct underground conduit; 1,980 independent and 2,377 joint telegraph offices. It had handled 40,288,453 domestic telegraph revenue messages.

BEHIND these bare statistics, if it could be read, is written the story of the nation's industrial, commercial and social life, in which each of these telegraph messages, speeding over miles of wire, had played its part, great or small.

How much of this large volume of telegraph business was transcontinental, it is impossible even to estimate. It is hardly more possible to estimate how much of the total wire mileage operated by these telegraph companies might be described as belonging to transcontinental circuits. Both companies maintain large numbers of permanently set-up circuits from coast to coast. In addition to these, there are many alternative routes which may be "patched in" for use in transcontinental communication if this becomes necessary or desirable for any reason.

Out of the development of telegraph, and later, of telephone service, have grown the network of private teletypewriter or printing telegraph lines, and the news and stock ticker systems that play so important a part in the business life of modern America.

Teletypewriter Exchange Service

OF particular interest in connection with a discussion which centers around the establishment of transcontinental telephone service is a form of communication by the written word

FIRST TELEGRAPH OFFICE IN SALT LAKE CITY

It was here, in October of 1861, that the wires from East and West were joined

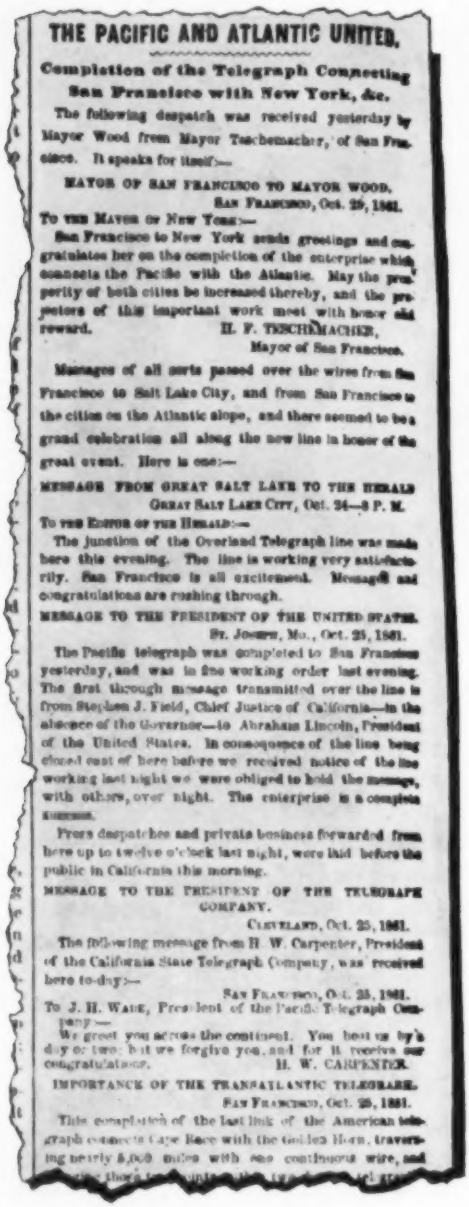
which is in some important respects analogous to telephone service and which utilizes telephone facilities for transmission—the so-called TWX or teletypewriter exchange service which for some years has been provided by the Bell System.

As its name implies, the teletypewriter is a device for "far-typewriting." It makes possible the electrical transmission of messages in typewritten form. Whatever is typed on the keyboard of the apparatus, while functioning as a transmitter, is transformed into electrical impulses which travel over the circuit to the distant apparatus which, functioning as a receiver, reproduces the original message exactly as it was typed on the transmitting machine. In most cases, the same machine may be used either for transmitting or receiving.

For many years, the Bell System has been providing private-line teletypewriter service to large numbers of subscribers. In 1931 it inaugurated teletypewriter exchange service, which enables any subscriber to the service to be connected with any other subscriber, after which transmission may be in either direction, as above described. This service has been discussed in detail in previous issues of the BELL TELEPHONE QUARTERLY.*

In the nine years that have elapsed since the inauguration of teletypewriter exchange service, its growth has been little less than phenomenal. The TWX directory of July, 1940, shows 13,337 customer stations and 218 of-

* "Modern Business Adopts the Teletypewriter," by J. M. Tuggey; QUARTERLY, October, 1935. "'TWX'—Its Growing Importance to the Nation's Business," by R. E. Pierce and J. V. Dunn; QUARTERLY, October, 1937.



THE PACIFIC AND ATLANTIC UNITED.

Completion of the Telegraph Connecting San Francisco with New York, &c.

The following despatch was received yesterday by Mayor Wood from Mayor Teschemacher, of San Francisco. It speaks for itself:—

MAYOR OF SAN FRANCISCO TO MAYOR WOOD.

SAN FRANCISCO, Oct. 25, 1861.

TO THE MAYOR OF NEW YORK:—

San Francisco to New York sends greetings and congratulates her on the completion of the enterprise which connects the Pacific with the Atlantic. May the prosperity of both cities be increased thereby, and the projectors of this important work meet with honor and reward. H. F. TESCHEMACHER,

Mayor of San Francisco.

Messages of all sorts passed over the wires from San Francisco to Salt Lake City, and from San Francisco to the cities on the Atlantic slope, and there seemed to be a grand celebration all along the new line in honor of the great event. Here is one:—

MESSAGE FROM GREAT SALT LAKE TO THE HERALD

GREAT SALT LAKE CITY, Oct. 24—8 P. M.

TO THE EDITOR OF THE HERALD:—

The junction of the Overland Telegraph line was made here this evening. The line is working very satisfactorily. San Francisco is all excitement. Messages and congratulations are rushing through.

MESSAGE TO THE PRESIDENT OF THE UNITED STATES.

ST. JOSEPH, Mo., Oct. 25, 1861.

The Pacific telegraph was completed to San Francisco yesterday, and was in fine working order last evening. The first through message transmitted over the line is from Stephen J. Field, Chief Justice of California—in the absence of the Governor—to Abraham Lincoln, President of the United States. In consequence of the line being closed east of here before we received notice of the line working last night we were obliged to hold the message, with others, over night. The enterprise is a complete success.

Press despatches and private business forwarded from here up to twelve o'clock last night, were laid before the public in California this morning.

MESSAGE TO THE PRESIDENT OF THE TELEGRAPH COMPANY.

CLEVELAND, Oct. 25, 1861.

The following message from H. W. Carpenter, President of the California State Telegraph Company, was received here to-day:—

SAN FRANCISCO, Oct. 25, 1861.

To J. H. WADE, President of the Pacific Telegraph Company:—

We greet you across the continent. You beat us by a day or two; but we forgive you, and for it receive our congratulations. H. W. CARPENTER.

IMPORTANCE OF THE TRANSATLANTIC TELEGRAPH.

SAN FRANCISCO, Oct. 25, 1861.

This completion of the last link of the American telegraph connects Cape Race with the Golden Horn, traversing nearly 8,000 miles with one continuous wire, and

A CONTEMPORARY ACCOUNT

This announcement of the consummation of a great undertaking, and summaries of congratulatory messages exchanged between the Atlantic and Pacific coasts, is reproduced from the New York Herald *of October 26, 1861*

ficial stations. These include subscribers in 1501 different towns. With cross references, the book contains 1871 separate locality listings, made up not only of the more important cities from coast to coast, but of hundreds of relatively small communities. To meet the needs of these varying sized communities, new types of TWX switchboards have been developed, and circuit setups have been improved. Scientific research and engineering skill, which gave the telephone a nation-wide reach, have given this new form of transcontinental service a network of facilities, and an acceptance by the public, that is also continent-wide.

Transcontinental Wireless Telegraph

We have thus far considered only those instrumentalities of transcontinental communication which have as their purpose the physical transportation of written messages, or the electrical transmission of such messages over physical, wire circuits. Let us turn briefly to the part which the wireless (or radio) telegraph plays in providing contacts between the two coasts of the United States.

Lack of space forbids an extended discussion of the early experiments of Hertz or the contributions of Clerk-Maxwell, Fleming, and others to the development of wireless communication. We cannot, indeed, dwell on Marconi's discoveries and inventions of practical means of sending messages through space, or on the developments in that field in which men like DeForest, Fessenden, and Alexanderson have played important parts.

It early became evident that the chief field of usefulness of the radio telegraph (and later of the radio telephone) was for communication between points which could not practicably be connected by land wires or cables. One of its first uses, as might have been expected, was in providing service between ships at sea and stations on shore. Its next field was in the establishment of transoceanic telegraph service, often in direct competition with existing telegraph cable services.

Following the establishment of such overseas telegraph services, the radio companies of the United States established overland radio services, primarily as a means of relaying messages from overseas, but secondarily as a means of providing purely domestic point-to-point communication. Such radio telegraph services have been inaugurated and are operated by the Radio Corporation of America, the Mackay Radio and Telegraph Company and Press Wireless, Inc. As above intimated, it is probable that the greater part of the traffic handled over these transcontinental radio telegraph channels is supplemental to transoceanic services. These companies, however, do a considerable amount of purely domestic business between a limited number of points.

Transcontinental Wire Networks for Radio Broadcasting

RADIO broadcasting is so essentially different in purpose from the point-to-point service provided by the facilities of the Bell System that it might almost be considered a different form of communication, and to deserve a section of its own in any study of the means which have been developed for linking the eastern and western coasts of the American continent. Broadcasting, as it is known in the United States today, particularly in its transcontinental aspects, is so vitally dependent upon networks of wire telephone circuits that the two means of communication become, in some respects, different forms of the same thing.

The story of the development of radio broadcasting, and of the place which telephone networks have had in this development, has been treated so often and so fully that there is little point in here dwelling on it at length. The transcontinental aspects of this development may, perhaps, deserve more than mere mention, for certainly the remarkable growth of radio broadcasting has been a vitally important factor in the recent economic, social, and political history of the United States.

A transcontinental telephone hook-up was first demonstrated to the public as an adjunct to radio broadcasting on February 8, 1924, when seven stations, at Havana, Washington, New York, Providence, Chicago, Oakland, and San Francisco were linked by 5,141 miles of wire, for the simultaneous broadcasting of a program being held at a dinner of the Bond Club, at the Congress Hotel, Chicago. General John J. Carty, who was in charge of proceedings at Chicago, "called the roll of the Continent" and twenty test stations, along the circuit linking Havana with the Golden Gate, responded as their names were called. Millions of people undoubtedly listened to this dramatic demonstration

of the extent of the facilities of the telephone system, and of the possibilities of radio broadcasting on a coast-to-coast scale. More than 4,000 letters were received by station WEAF, in New York, alone, expressing admiration for what was then considered an outstanding achievement of science and engineering, and is today accepted as a commonplace.

From this beginning grew the transcontinental radio broadcasting networks of today, over which it is not uncommon to serve more than 500 radio stations, with radio listeners running into millions that it is almost impossible to estimate. This development, in turn, had its beginning when the first transcontinental telephone line was built, twenty-five years ago—although the transmission afforded over that line would be far from satisfactory for broadcasting purposes today. Circuits intended for use in radio networks have to be specially engineered in order to provide the high quality of sound reproduction that their purpose demands.

Not Unlike Evolution

SUCH is the background against which must be viewed the opening for service of the first transcontinental telephone line, just a quarter of a century ago. We have called this development of coast-to-coast communication facilities the "conquest of a continent," and such it has been—a peaceful conquest achieved by a succession of steps, each one of which has followed the others by a process not unlike that of evolution.

As has been seen, there has been an irresistible force which has prompted Americans, from the very beginning of their history, to push their frontiers farther and farther westward. But there has been another force, equally irresistible—the urge to link these westward-moving frontiers with that which lay to the east of them. In doing this, Americans have inevitably chosen the best form of communication that, at any given time, man had been able to create. Always they have made use of the swiftest, most direct, and most dependable means then available for speeding their messages.

That the telephone would, some day, be numbered among these instrumentalities of transcontinental communication was almost a matter of predestination from the moment Bell spoke his first full sentence over an electric wire—*"Mr. Watson, come here; I want you!"* It was the wants of the American people—their social and economic and political needs—that made manifest the destiny of Bell's then crude instrument. Coast-to-coast telephone service was created, a quarter of a century ago, because nothing less direct and personal could longer meet the new and growing needs of the American nation.

Times of Testing

BY one of those unexplainable "coincidences" with which history is filled, this pioneer transcontinental telephone line was completed just in time to play its part in meeting a great national crisis. Even while gangs of linemen were setting its poles and stringing its wires, the nations of Europe were engaged in a titanic struggle. Hardly more than two years

after it was opened for service, the United States entered that conflict. Just as Overland Mail, Pony Express and Transcontinental Telegraph had, in turn, played their part in American life during a period of crisis, so this highway for coast-to-coast communication by the spoken word was to play its part when the American people were passing through a new time of testing.

To the first Transcontinental Telephone Line have been added three others. In a quarter of a century, telephone service has been speeded up, made vastly more efficient, more economical. Epochal advances have been made also in other forms of coast-to-coast communication that serve America—the railway and air mail services, telegraph service by land lines and by wireless, radio broadcasting.

ONCE more, America faces troublous days—days filled with problems which can be solved only by a people possessed of a common purpose, prepared for common action. That, just at this time, all of these facilities for the exchange of thought and opinion have been brought to so high a degree of effectiveness, may be only another "coincidence." But to those who are engaged in providing them, these continent-spanning instrumentalities for national unification are more than the mere results of fortuitous circumstance. They are manifestations of an age-old purpose, any contribution to the achievement of which by present-day Americans is a high privilege, carrying with it large responsibilities.

That purpose has created the wires and waves and rails and pathways for planes which stretch from the Atlantic to the Pacific today, as it created the Overland Mail and the Pony Express. It is a purpose that was best stated when our American form of government came into being: "We, the people of the United States, *in order to form a more perfect union. . . .*"

FOR THE RECORD

THOMAS I. PARKINSON ELECTED A DIRECTOR

At the meeting of the Board of Directors of the American Telephone and Telegraph Company on November 20, Thomas I. Parkinson was elected a Director to fill the vacancy caused by the death of Hale Holden. Mr. Parkinson is President of The Equitable Life Assurance Society of the United States, and has been a director of the Western Electric Company, Inc.

F. P. LAWRENCE IS NEW HEAD OF LONG LINES

Frank P. Lawrence, Vice President and General Manager of the Manhattan Area of the New York Telephone Company, has been elected Vice President of the American Telephone and Telegraph Company in charge of the Long Lines Department, effective January 1. Mr. Lawrence succeeds Vice President Cleo F. Craig, who will take charge of the Department of Personnel Relations upon the retirement of Vice President Karl W. Waterson next March. Mr. Lawrence was born in Newark, New Jersey, and was graduated from Lehigh University. He entered the telephone business in 1912 as an engineer in the Southwestern Bell Telephone Company in St. Louis. He served in Kansas and Oklahoma before coming to New York in March, 1929, as General Plant Manager for the Upstate Area, with headquarters in Albany. He moved to New York City in 1933 and was elected Vice President and General Manager in 1938.

RADIO TELEPHONE SERVICE OPENED WITH GREECE

Greece was brought within reach of Bell and Bell-connecting telephones on January 12, when the A. T. & T. Company's transatlantic telephone service was extended to include that country. The new service is provided by means of a short wave radio circuit between New York and Berne, Switzerland, and from there to Athens by means of land lines via Zurich and Belgrade. The New York-Athens connection is nearly 5,000 miles long.

NOW MORE THAN 17,600,000 BELL TELEPHONES

In 1940 there was a net gain of about 949,900 telephones in service in the principal telephone subsidiaries of the American Telephone and Telegraph Company included in the Bell System. This was the largest increase for one year in the history of the Bell System. The largest previous annual gain was 876,000 in 1937. The gain in 1939 was 775,000. At the end of December, 1940, there were

about 17,483,800 telephones in the Bell System. The gain during January of 1941 was about 129,400, bringing the total Bell System telephones to about 17,613,200 as of January 31. By the end of 1940, all the operating telephone companies in the Bell System had passed their pre-depression peak numbers of telephones in service.

The total number of telephones in the United States which could be interconnected, including those of the Bell System and several thousand independent telephone companies, was about 21,830,000 at the end of 1940. As of January 31, 1941, the number is approximately 22,000,000.

THE "QUARTERLY" BECOMES THE "MAGAZINE"

BEGINNING its twentieth year with the present issue, this publication changes its name from the *Bell Telephone Quarterly* to the BELL TELEPHONE MAGAZINE. While no change in editorial policy is contemplated, the new name seems more appropriate to the magazine's scope and content, and the change of title will permit greater flexibility of publication dates.

CONTRIBUTORS TO THIS ISSUE

ENTERING Yale in 1914, JUDSON S. BRADLEY left college in 1917 to enlist in the U. S. Army Ambulance Service. Returning from overseas in 1919, he reentered college, and received his B.A. degree in 1920. For the next four years he was assistant editor and managing editor of the *Yale Alumni Weekly*. In 1925 he joined the Publicity Department of the Southern New England Telephone Company, in New Haven, as copy writer, and was subsequently advertising manager until 1928. In that year he was transferred to the Commercial Division of the American Telephone and Telegraph Company, and in 1930 became a member of the staff of the General Information Department. He has contributed several articles to the QUARTERLY, of which the most recent was "At the Customer's Service," in the issue for October, 1940.

GRADUATING from Purdue University with the degree of B.S. in E.E. in 1921, OTIS M. HANCOCK entered the Bell System immediately as a student engineer with the Ohio Bell Telephone Company in Cleveland. After completing the student training course he was assigned to commercial work, and in 1923 was made Directory Production Supervisor. In 1927 he joined the staff of the Commercial Engineer of the A. T. & T. Company, and since 1929 has been in charge of the group handling directory production and service problems.

BATES COLLEGE graduated ROBERT L. TOMBLEN with the degree of B.A. in 1914, and Worcester Polytechnic Institute with the degree of B.S. in E.E. in 1917. He joined the Long Lines Department of the A. T. and T. Company in July of the latter year as a student in traffic engineering, but left for military service in September. After 19 months of army duty in this country and overseas he rejoined the A. T. and T. Company in the Commercial Engineer's Division of the Department of Operation and Engineering. Here he was engaged for several years in making commercial surveys of some of the principal cities of the country. In 1929 he transferred to the Chief Statistician's Division of the Comptroller's Department, where he continued his market research and popula-

tion studies. He is a member of the Population Association of America, and has contributed a number of articles to the QUARTERLY, the most recent being "The Sixteenth Decennial Census," in the issue for April, 1940.

RECEIVING the B.A. degree from Lafayette College in 1907, and the LL.B. degree from New York Law School in 1909, ROBERTSON T. BARRETT practiced law until 1918, and for the next three years was engaged in newspaper work. In 1921 he joined the Information Department of the A. T. & T. Company, and since 1936 he has combined his duties in that department with those of Historical Librarian of the A. T. & T. Co. He is editor of the *Telephone Almanac*, and has contributed a number of articles to the QUARTERLY, the most recent being "The Telephone as a Social Force" in the issue for April, 1940.